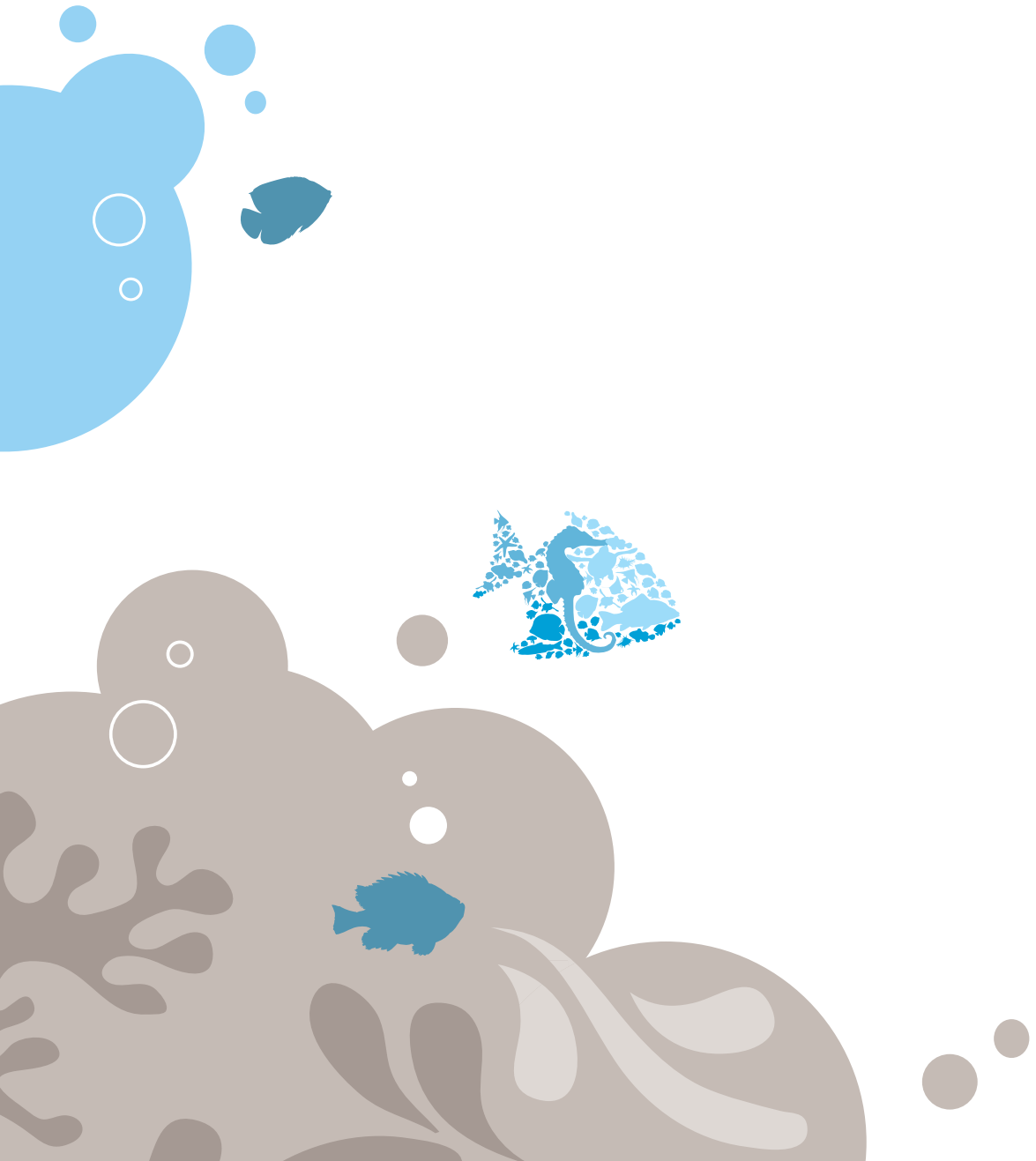
Annual report
2010

Ifremer



Foreword

In 2010, Ifremer's teams were highly mobilised on subjects where the stakes are high, such as understanding the serious crisis affecting the shellfish farming sector and working in liaison with the professionals concerned to combat it; taking the marine energies theme forward; taking part in the studies and follow up to the Grenelle marine summit meetings; progressing in expertise on deep sea mineral resources; continuing the work for the extension of the continental shelf and improving our knowledge about marine biodiversity.

These topics have put a range of scientific and technological skills and expertise in motion, particularly in the framework of ocean research cruises, including that conducted last summer in the zone of Wallis and Futuna islands within a public-private partnership. Its results are being analysed and hold great promise.

Our institute also pursued its expert assessments in fisheries science and on marine aggregates. We have improved analytical and health monitoring methods for shellfish farming areas, working closely with the professionals, and more specifically in the form of shellfish farming conference meetings.

Ifremer has also drawn up numerous agreements for collaborative work.

First of all, the Institute has undertaken numerous partnerships with French coastal regional councils, universities and research bodies. Industrial firms interested by ocean research cruises or business developments of technologies developed by Ifremer are also included in these partnerships.

In terms of bilateral agreements, 2010 saw the kick-off of a general strategy for Franco-Brazilian cooperation to prepare the Sanba 2011 cruise in the Santos basin and of reinforced cooperation with German, British and Spanish partners in Europe, especially to prepare joint programming for marine sciences.

The year 2011 promises to be full of new challenges, including the Institute of excellence carbon-free energies project, support for the technological research platform on marine energy sources; progress in the application of the Water Framework and Marine Strategy Directives; setting up the joint service unit to coordinate scientific fleet management for Ifremer and our partners (IRD, INSU, IPEV); the extension of the ISO 9001 certification approach to the Institute as a whole; and preparing the eighth European Framework Programme for Research and Development with the perspective of stronger synergies in the field of marine sciences (Eurofleets project, joint programming, etc.). These are some of the many opportunities for Ifremer teams to deploy every facet of their expertise and talents.

Jean-Yves Perrot
Chief executive officer of Ifremer

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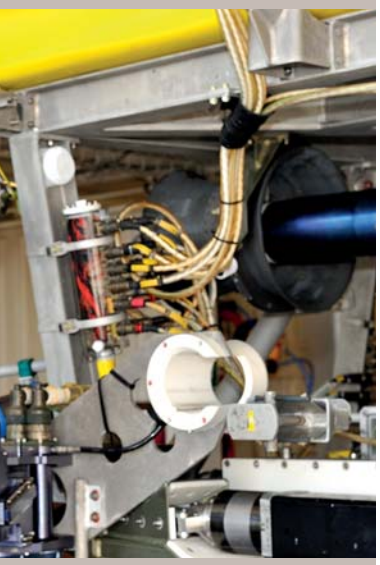

The 2010 Ifremer Trophies

As awards organised for the second consecutive year, the Ifremer Trophies provide a unique opportunity to honour scientific excellence, the spirit of innovation and the strong personal commitment of the people who work in our Institute. The trophies are also a means of making Ifremer's work and studies better known and of presenting our teams and individual or collective research and achievements from a new angle. The ceremony was hosted by the journalist and sailor Catherine Chabaud and was held on 19 October 2010 at the Musée national de la Marine.

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Scientific publication trophy

This trophy was presented by Patrick Monfray, director of research at CNRS and programme manager at the ANR, and rewarded Patrice Klein, director of research at Ifremer and Guillaume Roullet, researcher and lecturer at the University of western Brittany (UBO) for their publication entitled *"Cyclone-Anticyclone Asymmetry in Geophysical Turbulence"* which was published in *Physical Review Letters*.

In it, the authors provide a description of geophysical models on very small scales which show how marine life is dependent upon physical aspects. Numerical simulations were performed at a spatial resolution never previously attained.

Their studies, particularly on simulation of new theoretical models, should prove to be fundamental and explain why certain species (plankton, phytoplankton) live in certain areas.

Industrial partnership trophy

It was Laure Reinhart, deputy managing director of Oséo, who presented this trophy to Ifremer's Geophysics and Geodynamics laboratory for the coordination of the Sanba project (Santos Basin).

This major scientific collaborative project was carried out with Brazilian universities, the University of Lisbon and IUEM, and with support from the world-class Petrobras oil company. It aimed to obtain scientific data which would improve understanding about sedimentary basins and the creation of margins in the South Atlantic Ocean, in order to validate a novel scientific model concerning the geodynamics of the Santos basin.

Scientific, technical or technological innovation trophy

This trophy, presented by Laure Reinhart, Oséo deputy managing director, rewarded the "Digital processing of calcified specimens" (TNPC) image analysis software developed by the sclerochronology cluster at Ifremer's Channel-North Sea centre in partnership with the national engineering school in Brest (ENIB) and the Noésis company.

The TNPC software provides assistance in quantifying and interpreting calcified specimens and digital storage of biological material, facilitates exchanges of data and lowers costs thanks to automated processes.

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Scientific mediation trophy

Presented by the journalist and yachtswoman Catherine Chabaud, the trophy was awarded to the teams at Ifremer's Pacific centre for the organisation of meetings called "Feedback days for research results on pearl farming in Polynesia" in partnership with the Ministry of marine resources in French Polynesia and the pearl farming service. They were held on the 3rd and 4th March 2010.

The two days of meetings were very well attended by pearl farmers. They showed the interest of our Institute's research for the sustainable development of this value chain, which is of prime economic importance for French Polynesia. The entire profession unanimously backed up Ifremer's future research orientations.

Scientific achievement trophy

The trophy, presented by Philippe Vallette, general manager of the national sea centre Nausicaa, was awarded to Ifremer's Marine geosciences department for the GoloDrill ocean drilling cruise performed in the Mediterranean, in the framework of international cooperation with the Fugro company and oil industry partners.

Thanks to this cruise, the scientific community now has access to exceptional data which will help establish conceptual models on sedimentary evolution in continental margins of Eastern Corsica. The data will also provide access to very high resolution recording of climate variability over the past 500,000 years and understanding of the impact these changes had on environments in the past.

PhD thesis trophy

The trophy was presented by Philippe Vallette, Nausicaa's general manager, to Sandie Millot for her thesis on "Domestication, selection and behaviour of Sea bass (*Dicentrarchus labrax* L.): variability in behavioural abilities and stress tolerance in different strains".

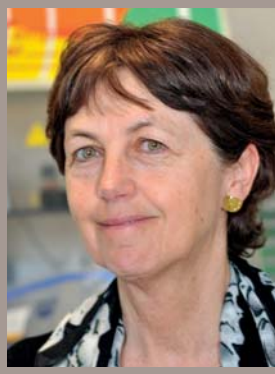
Her thesis highlighted the fact that domesticating sea bass improved the speed at which they learned and adapted to rearing conditions and that selecting for growth favoured animals which display a regular feeding rhythm, as well as significant ability for exploration and variable growth over time.

Scientific career trophy

This trophy was presented by Jean-Luc Clément, a university professor and research advisor to the Director of European and international relations and cooperation at the Ministry of higher education and research, to Lionel Loubersac, who is Ifremer's deputy managing director in New Caledonia and the head of the "Lagoons, ecosystems and sustainable aquaculture in New Caledonia" department.

His career path illustrates the specificities of Ifremer. Lionel Loubersac has been highly mobile, having made several stays overseas, and along with his career as a scientist is that of manager, which has led to his position of responsibility at the New Caledonia delegation.

Jury's special award



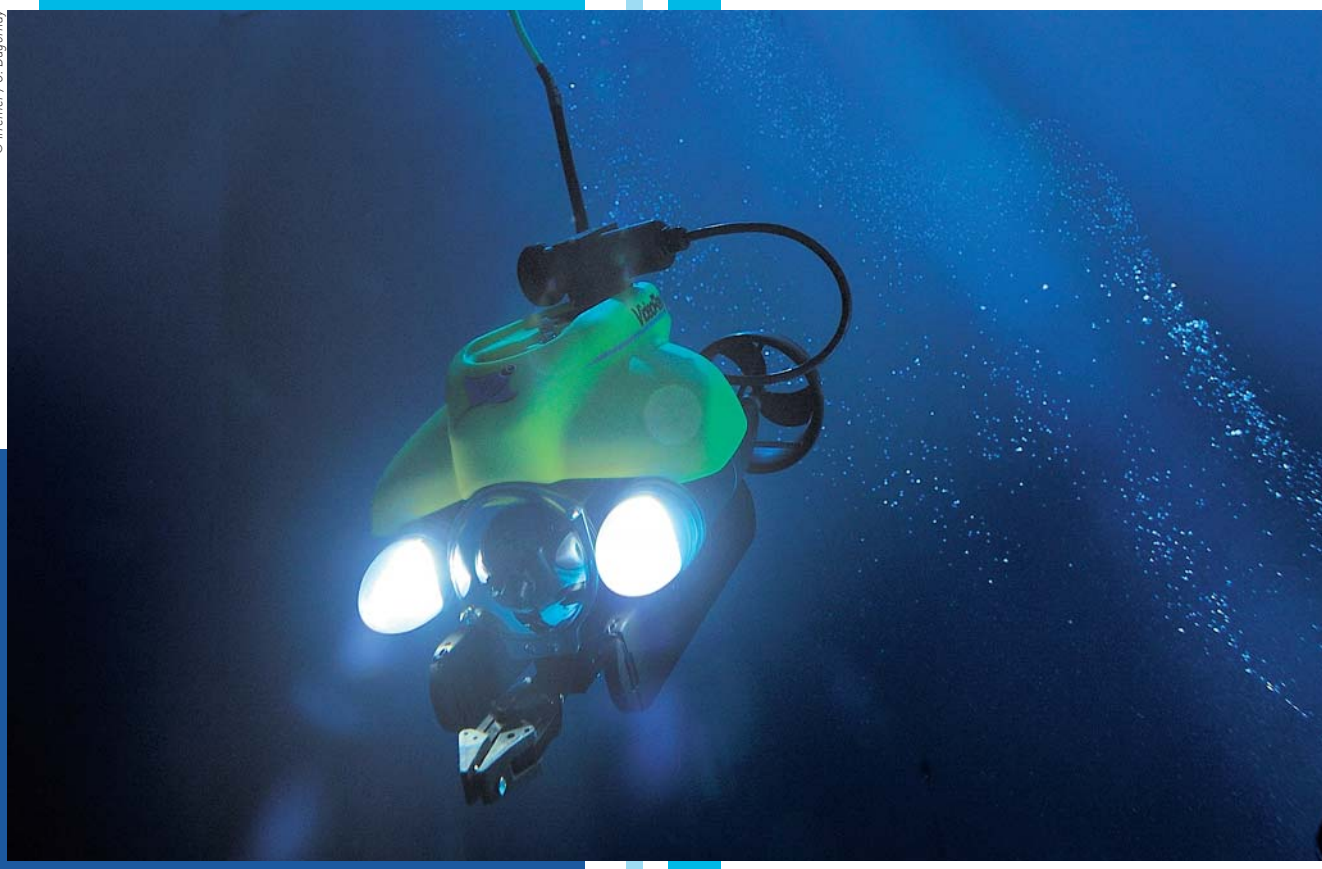
Jean-Yves Perrot, the Chief Executive Officer of Ifremer, accompanied by members of the jury, awarded the 2010 special jury's prize to Chantal Cahu, who is head of the "Functional physiology of marine organisms" department and in charge of the "Aquaculture" and "Biotechnology" sectors within the Prospective studies and scientific strategy directorate.

Chantal Cahu began her career as a scientist at the Cnexo in 1981 and devoted her work to studying the physiology of crustaceans, and then fish, with the aim of acquiring fundamental knowledge and applying it to help aquaculture's development.

Her research led to tangible developments in particular with the filing of a patent for an invention marketed in numerous countries.

Chantal Cahu is also the author of some seventy publications in A-ranked journals and of a large number of reports. She has taken part in numerous public debates and in several national and European projects. She has contributed to scientific facilitation in France through her involvement in establishing and operating UMR joint research units, through coordinating or participating in working groups and scientific advisory committees.

Acknowledged by her peers both in France and abroad, Chantal Cahu often reminds us that all her research is done by teams and that her studies are made possible thanks to the strong involvement of PhD students and postdoc fellows with whom she particularly appreciates working.



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Major research and expertise

Monitoring, use and development of coastal seas

Studies in the coastal ecosystem dynamics, assessment and monitoring programme revolve around three main themes: 1) research for better knowledge about ecosystems (effects of chemical contaminants coastal habitat monitoring, etc.) to help define environmental indicators; 2) marine environmental quality monitoring; and 3) value-added utilisations of data produced by the different monitoring networks.

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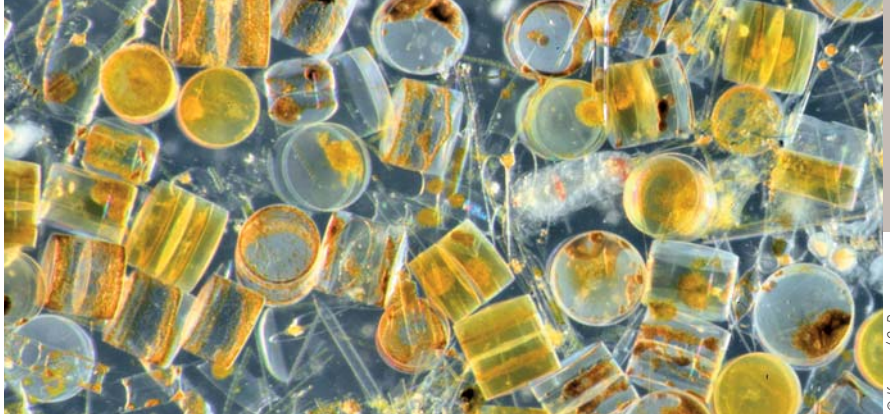
Seashore at Piriac

Fate and effects of chemical **contaminants**

Research to learn more about the activation pathways of PAH (polycyclic aromatic hydrocarbons) in marine finfish, particularly by identifying the reactive metabolites for the genetic material, focused on two approaches: chemical characterisation of the biotransformation products (metabolites) of the carcinogenic PAH BaP (Benzo(a)pyrene), and of fluoranthene, followed by a comparative study of their genotoxicity. Amongst the numerous results published in 2010, the characterisation of some BaP metabolites could ultimately lead to genotoxicity markers which are specific to this family of chemical pollutants being defined.

This study was conducted in the frame of an Ifremer PhD thesis, in cooperation with several research organisations: LPTC in Bordeaux, Xenobiotics UMR in Toulouse and the Nucleic acid lesions laboratory (LAN) at CEA in Grenoble.



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Phytoplankon

Quadrige² information system and value-generating products

The deployment of Quadrige², particularly to partners in the Rebent network, was completed in 2010. It is accompanied by a programme to help with the start-up and training (nearly seventy users, including twenty-six partners) and a programme to recover data from previous legacy, particularly WFD data.

The data qualification work continued, through exchanges with coastal laboratories and the development of semi-automated processes.

In 2010, the Quadrige² database received the further input of hydrology data for the Loire and Brittany regions, Rebent (UBO database, sea grass beds and posidonia meadows) and Réunion, in the Edilabo format (specifications work conducted by the Sandre national water data and benchmarks administration service for electronic data exchanges between those commissioning and those providing studies or data in the field of water); the data for the French West Indies were structured; and new thematic fields have been opened (such as toxins for phytoplankton). Nearly 204,000 results from Ifremer's various networks (Rocch, REMI, Rephy, IGA, Rebent and Remora) have been entered, reviewed or computed.

The Quadrige² database is also linked to the Surval data dissemination tools, for which several products are being deployed.

The finalised and validated Sandre national exchange format for coastal waters will used in exchanges with the Onema's S3E water status assessment system which is currently being defined.

Quadrige², monitoring the coast

Environmental data from the monitoring networks of Ifremer (Rocch, REMI, Rephy, Rebent, IGA, etc.) and our partners (Repom, Dragage, etc.) are managed by the Quadrige² information system.

The system has over three hundred users, Ifremer laboratories and partners (20% of users), including the Ministry of works and amenities Coastal water quality units, and is the French benchmark for marine environmental data for the Water Information System.

Portal: National administration for water data and benchmarks (Sandre)

Bulletin and **statistics** for coastal monitoring

In the framework of developing tools and value added products from the Quadrige² database Ifremer plays a part in interpreting and disseminating monitoring data by providing training for statistics coordinators in the network and in coastal laboratories (LER).

In 2010, one thousand paper copies of the monitoring bulletin were distributed to LER labs. Two days were organised on the "products", to identify and draw up specifications for the Quadrige² information system's operational outputs.

For the REMI network, programmes to estimate zone quality were run in the context of the "REMI annual report" produced by the LERs. Data for the European Environment Agency (EEA) and Ospar were transferred, and the recommendations from the monitoring bulletin's ten-year audit were taken into account in the code. A special development was created for the SRC's quarterly newsletter and the IGA annual report.

WFD quality criteria

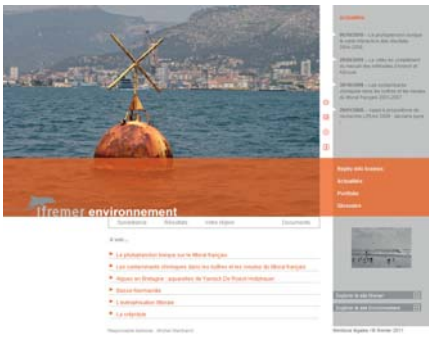
Studies on the Water Framework Directive (WFD) quality criteria continued, in particular, with:

- developments on the indicator for intertidal and subtidal macroalgae,
- finalisation of the "benthic invertebrates" quality element and its application to the 2003-2008 period,
- coding and implementation of the "turbidity", "salinity" and "transparency" quality elements over the 2003-2008 period,
- studying the species composition indicators for the phytoplankton quality element.

Several studies were carried out concurrently using the data from monitoring: the "mouse test vs. chemical analysis" for Réphy, "18 years of REMI" and "Difference in contamination between burrowing and non-burrowing shellfish for REMI.

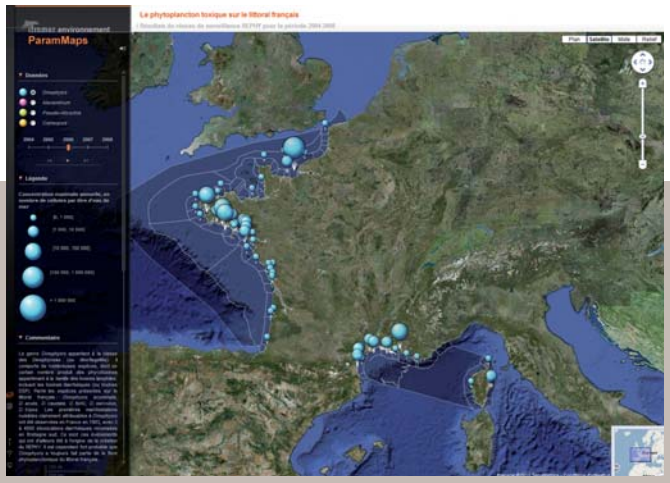
Ifremer's **Coastal** environment website

Logging nearly 100,000 "clicks" a month, Envlit is the second most-consulted of Ifremer's websites, after the institutional site. It disseminates all the information about the coastal environment to a broad readership and provides free access to monitoring data (maps, graphs, downloadable time series, etc.).



In 2010, Envlit was selected to disseminate information from monitoring done under the WFD. The defined framework provides national scale benchmarking along with information on operational monitoring in each catchment. A separate WFD was created on the site's pages on "Monitoring". Results from the Loire-Brittany and Adour-Garonne catchment basins are presented as atlases which were developed in partnership with the Water agencies.

Two new ParamMaps have been put on line and an additional product that could be deployed via smartphones is being investigated. Adjustments were made to the first version of Surval delivered, as well as to the cartographic layers, before they were put on line in early 2011.



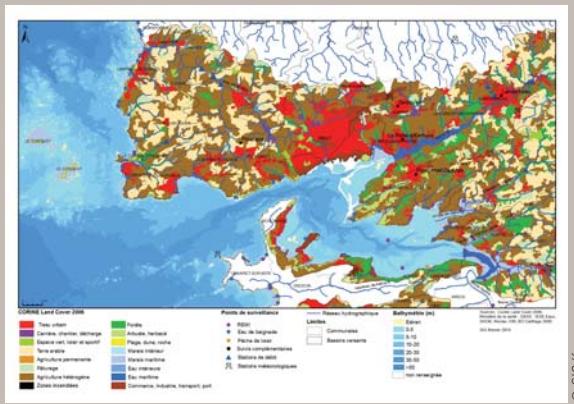
Toxic phytoplankton on the French coast: Réphy network results for the period from 2004-2008

An **Atlas** on a memory stick

In order to comply with the European Community's regulatory requirements on control of products of animal origin intended for human consumption, a national study to identify the origins of microbiological contamination of human and animal origin was conducted by Ifremer in the REMI (microbiological inspection network in shellfish-farming areas) framework. It was completed in 2010.

All existing data has now been compiled in the *Atlas national des sources de contamination microbiologique des zones de production conchylicoles*. Distributed on a memory stick (USB flash drive) to a hundred organisations, this cartographic (GIS) atlas is presented by catchment area and per various themes: population, tourism, wildlife, land use on the scale of the catchment, spraying and spreading, and draining.

National Atlas map of sources of microbiological contamination in shellfish farming zones



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OCEAN AND HEALTH

In 2010, Ifremer carried out a series of research, monitoring and expert assessments, all based on forecasting and controlling the effects of toxic microalgae blooms and studying emerging microorganisms in coastal areas which present hazards for human health, particularly though the contamination of shellfish.

Preventing risk of **contamination**

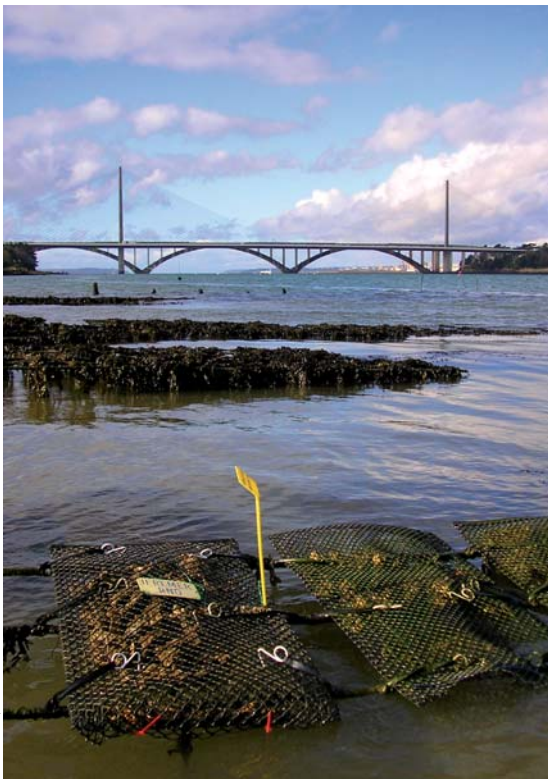
During the year 2010, scientific studies performed in the framework of the "microbiological contamination and coastal uses" were covered in numerous papers and presentations both nationwide and abroad. The interest of all the studies and expert appraisals carried out in the National Reference Laboratory (NRL) resulted in an increase in funding allocated by the General directorate for food (DGAL). The two actions presented below illustrate part of the outstanding progress made in 2010.

Identification of risks

Norovirus are the main viral agents involved in gastroenteritis. The ways that human and bovine noroviruses bind to shellfish tissues, as well as the cupped oyster's ability to concentrate them, determine the related health hazards (e.g., collective food poisoning) and possible methods to purify the shellfish. Studies have shown that there are different binding profiles in the oyster depending on the strain of virus and the season. Initial approaches done on mussels, cockles and carpet shell clams did not show any specific binding. Likewise, the absence of the bovine Norovirus ligand in the oyster limits the contamination of shellfish, thus confirming the results of an initial environmental study.

A "tool box"

Implementing preventive and remedial action requires that the sources of contamination be identified. Bacteroidales (bacteria which are abundant in gut flora) markers have proved to be effective in finding contamination of human or animal (ruminants and pigs), origin in all types of water. A "tool box" comprised of nine microbiological and chemical markers on common water samples (effluents, stream or coastal waters), was developed in order to meet the needs of water managers and local authorities. The markers were transferred to analytical laboratories. One of the three Bacteroidales markers (Pig-2-Bac) was chosen for the inter-calibration trials conducted by laboratories in North America (twenty American and European participating laboratories).



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Site where oysters were sampled in the Elorn estuary (Finistère, France) whose source of contamination was assessed using bacteriodales markers (March-May 2010)

Understanding microalgae **blooms**

For the past few years, understanding the dynamics of toxic algae which develop in the marine environment has been a challenge for Ifremer. Its studies focus on discovering new methods to identify species and their biodiversity, on mechanisms that control the appearance of microalgal blooms and on improving the methods used to compute forecasts. In 2010, new cooperation began with the *Museum Senckenberg Institute in Wihelmshaven* (Germany). Ifremer is also the only French research body taking contamination hazards due to ballast water into account.

Anticipating and controlling algal **blooms**

The microalgae which cause diarrhetic shellfish poisoning *(Dinophysis)* are the cause of most shellfish farm closures in France. Therefore, Ifremer is committed to understanding the origin and dynamics of these species development.

Study of the hydrological parameters (current, turbulence and thermocline) of areas where *Dinophysis acuminata* are abundant, and of the phytoplankton's biological features, have yielded an accumulation of invaluable data on the systems which control the emergence of these toxic phytoplankton. Nutrition of mixotrophic *Dinophysis* (which can use several carbon sources) is currently taken into account in developing a conceptual growth model. Developing a prediction scheme for *Alexandrium minutum* (which produce paralytic toxins) and parametrizing the effect of temperature on phytoplankton growth, in the laboratory, are concrete outcomes of several years of experimental approaches and *in situ* observations.

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Sampling of sediments to find Alexandrium minutum *cysts*

To understand how these blooms could be neutralised by parasites, mathematical and statistical relationships of the dynamics of the phytoplankton and its parasite's vertical migration were drawn up in collaboration with CNRS, and then verified in the laboratory. In the Thau lagoon, Ifremer is preparing a model to predict *Alexandrium catanella* blooms based on a series of multi-annual data and monitoring of shellfish contamination by this species.

Blooms of *Pseudonitzschia* (producing amnesic toxins) are also being studied in order to titrate their toxicity and establish a shellfish contamination pattern.

Ballast water, factor of toxic algae dissemination

Discharges of ballast water by cargo ships in merchant harbours present a risk of contamination leading to the introduction of new species of microalgae. Ifremer has set up a pilot system, dubbed a "ballastodrome", to assess how effective ballast water treatments are, and a pump/filtering system to sample the microalgal flora present near ships on call.

Eradicating **contamination**

Culturing of the *Azadinium spinosum* microalgae, which was done in order to study its toxin production, proved it was feasible to purify toxins using the algae producing them. Thirty-five grammes of algae paste produced in ten days, from which approximately 7 milligrammes of toxins extracted can be used to produce certified calibrants. This study backs up the change in legislation leading to the introduction of a liquid chromatography method combined with tandem mass spectrometry tandem (LC-MS/MS) as an alternative to the mouse bioassay for lipophilic toxin determination.

Shellfish purification

In June 2010, Ifremer presented the conclusions of a study on protection and on shellfish contamination/decontamination methods, carried out within the Comsaumol project, to shellfish farming professionals. The research confirms that it is possible to protect oysters for several weeks in re-circulating loop water tanks with low renewal rates. Membrane filtering of the supply water enables more than 99% of toxic algae to be retained, whereas the effectiveness of sand filters only reaches 90%. The risk of contamination of bivalve molluscs stored in tanks is eliminated *a priori* when they are supplied with contaminated, but filtered, seawater.

Ifremer's study on quantification of the marine biotoxins recorded successfully participated in four exercises to validate the method, three of which were for lipophilic toxin determination using LC-MS/MS. This analysis was also revalidated on the total flesh matrix.

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SPR biosensor mounted on a profiler during the Pseudomo cruise

Sensors to identify species

Ifremer developed several types of sensors for the identification of toxic microalgae species.

Currently, a DNA microarray or biochip is used to detect five species of *Pseudo-Nitzschia (P. australis, P. multiseries, P. pungens, P. fradulenta* and *P. americana)*. to do so, sixty probes (DNA strands) have been tested, in collaborative work with the Toulouse Génopole Biopuces platform. The method chosen for total RNA extraction enables the RNA to be purified directly on the filter. The reliability of a quantitative biochip is being studied.

To detect other species of *Pseudo-Nitzschia (P. americana, P. australis)* a protocol was developed using fluorescent *in situ* hybridization (FISH) on a filter. This microscopic quantitative analysis method is based on an *a posteriori* observation of the morphological criteria of the phytoplankton. Although staining has yielded promising initial results, the protocol must still be perfected to enable multiplexing (using several probes during hybridization).

An immunochromatographic strip test developed in collaboration with CEA at Valhrô, to detect *Alexandrium minutum*, could be a relevant diagnostic test for shellfish farmers. It should be validated in 2011 and 2012 on natural seawater samples.

Identifying **toxins** *in situ*

Pseudo-Nitzschia produces domoic acid which is toxic. A way to detect low concentrations of domoic acid *in situ* was successfully validated. In partnership with the National Ocean Service of NOAA (USA), a domoic acid biosensor based on Surface Plasmon Resonance (SPR) and using domoic acid antibodies (developed by NOAA) was validated in September 2010 during the Pseudomo Leg2 cruise along the coast of the English Channel. The biosensor can assay domoic acid in association with a fluidic system built into the pelagic profiler. Ifremer detected domoic acid at concentrations ranging from 0.1 -1 ng.mL-1, added to bags filled with seawater solutions.

A **pelagic** profiler

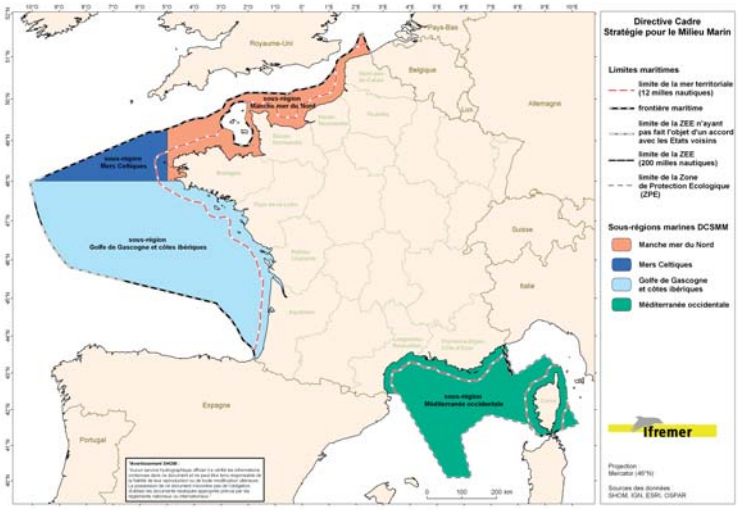
Ifremer is developing optimised instrumentation, which is utilised both in research programmes and in monitoring programmes (Réphy). During 2010, the profilers designed at Ifremer were used on three ocean research cruises: Pseudomo Leg1, Leg2 and Per2Tong (experimental programme on solitons and plankton in the Bay of Biscay). A pelagic profiler used in conjunction with various optical sensors (fluorimeter, laser granulometer and a video-fluorescence microscope) delivered precise targeting, accurate to twenty centimetres, of the water layers to be sampled The results were disseminated in A ranked journals and at conferences.

Improved sampling **quality**

Our Institute also perfected a new interfacing tool for a CTD on Pocket PC. It optimises the sampling quality based on observation of the data from the sensors (thermal stratification, detection of layers of phytoplankton abundance). The equipment was used in 2010 by CNRS Roscoff in the Penzé River (ANR Paralex) and by the Environment-Resources laboratory in Sète in the Thau lagoon to measure phycoerythrin, a pigment contained in toxic cyanobacteria colonies, using fluorescence.

Marine strategy framework directive

On the European level, the publication on 2 September 2010 of the Commission's decision on criteria and methodological standards concerning the good environmental status of marine waters was a milestone in the implementation of the Marine Strategy Framework Directive (MSFD). This document brings the work of expert groups, which had met from winter 2009 onwards and within which Ifremer made significant contributions, to a close.



The French organisation set up to fulfil the requirements of the Directive became operation in 2010 under the authority of the MEDDTL. The implementation of the MSFD will be done in the framework of the Marine environment action plan (PAMM). Strong steering on a national level is planned in organising this, along with attributions on the level of the four marine subregions which concern France: North Sea/English Channel, Celtic Seas, Bay of Biscay and Western Mediterranean.

MEDDTL put Ifremer in charge of coordinating the initial assessment of the current environmental baseline status. Ifremer also contributed to the "pressures and impacts" and "socio-economic analysis" strands coordinated by the Agency of marine protected areas (AAMP).

To guarantee the scientific quality of the studies "referent-experts" have been designated, half of them (about fifty) come from Ifremer research teams. Our Institute also ensures the scientific coordination of defining good environmental status based on eleven generic descriptors. For each descriptor, a "lead partner" is designated to guide the national level think tank and cooperate with their counterparts in countries in the same subregion. Ifremer researchers are the leaders for the descriptors of "exploited species", "eutrophication", chemical contaminants in the environment", "marine litter", and joint leader with SHOM, for the "introduction of energy into the marine environment" descriptor.

A tool to help assess and manage **MPAs**

The Pampa project aims to test and analyse a set of marine protected area performance indicators to manage coastal ecosystems, their resources and their uses. It is financed by the Liteau programme and receives strong support from Ifrecor and the Agency of marine protected areas.

In 2010, the project's third year, data collection (on biodiversity, user surveys and MPA governance) was completed. Building of the indicators made particularly good progress thanks to several workshops held in the Mediterranean region and a workshop on Réunion Island for sites in overseas France. The selected metrics were tested. Two workshops organised towards the end of 2010, brought the project's twenty-five partners together to conduct tests, formalise the score cards and road maps and define the deliverables.

This took the Pampa project into its product finalisation and feedback phase.

Nature and **landscapes** information system

The marine component of the National information system on nature and landscapes (SINP-mer) has the main objective of networking the various databases containing data on marine biodiversity in France and to facilitate access to it. The project whose contracting authority is MEDDTL, associates Ifremer, in charge of technical project management, AAMP and the National museum of natural history (MNHN). In 2010, the following actions were carried out:

- creating a theme-based website. The site includes a metadata catalogue which enables each user to select, download, and manipulate the various cartographic layers in order to construct specific biodiversity views (habitat maps, etc.);
- integration of biodiversity data, particularly that on marine mammals from the marine mammals research centre in La Rochelle;
- development of a new version of the Sextant database (coastal monitoring), incorporating the database access functions like that of the Quadrige² coastal monitoring database;
- and the creation, now being finalised, of various "products" based on Sextant and focusing on a given theme.

Developing analytical tools for MPA **governance**

The Gaius project is now in its finalisation phase and is the fundamental counterpart to the Pampa project, in which Ifremer's contribution involved synthesis tools to analyse MPA governance. The studies revolved around three theses (co-financed by Ifremer or the Zoneco programme) which fell under both the Gaius and Pampa projects. Two of them used the ISIS-Fish modelling tool to produce indicators for the dynamics of fisheries managed with MPAs. Two of the three PhD theses won awards, respectively in 2009 and 2010, at the Ifremer "PhD student days" event.

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Blotched fantail ray acquired by the autonomous Micado station in New Caledonia

Tools **to observe** biodiversity

Since 2007, video techniques to observe subsea biodiversity have been developed in New Caledonia. Various surveys in the field have confirmed that the techniques are operational to observe vagile macrofauna and habitats. Their main advantages are incomparable spatial coverage, absence de bias ("diver" effect) and the archiving possibilities.

In 2010, 333 stations were performed during 24 days at sea in the zone of Grand Noumea. 77% of these stations provided exploitable data. The Micado underwater video station was tested in the Mediterranean: analysis of images from the 45 stations performed confirmed that the technique could be transposed there.

In 2010, 800 stations out of the 1,444 that could be exploited were analysed. The data were used in the framework of the Pampa and Gaius projects and supplied the indicators of biodiversity (compared to other indicators, etc.).

The data accumulated and the interest shown for the technique for the monitoring of biodiversity led Ifremer to undertake the databasing of the information collected.

In order to transfer this monitoring method to the services which manage the marine environment, a methodology guide on implementing the technique was produced and will be accompanied by a documentary video produced in cooperation with IRD.

The technique was selected by AAMP and the Brittany and PACA marine clusters as a monitoring assistance tool for a demonstrator in 2011.

A **multidisciplinary** survey

The "Scattered islands" 2010 cruise was organised by Ifremer, AAMP, the ARVAM marine research and valorisation agency and the National marine reserve PIG of Réunion Island, thus combining three objectives:

- sampling of three fish species in the framework of a study on the connectivity of MPAs in the South West Indian Ocean (CAMP project). Fifty-five individual fish of these three species were collected, along with samples from other species for the genetic analyses underway;
- performing "ground truthing" (after acquisition of Lidar bathymetric data and hyperspectral images) to map subtidal habitats in the Juan de Nova and Europa islands. This operation supplemented the spectral library begun in 2009 with the hyperspectral signatures on the types of seabeds which had hardly been sampled until now, and data on still unexplored targets of interest (algal cover, specific coral mounds, etc.);
- highlighting the importance of the islands of the SW Indian Ocean as a habitat where marine turtles develop. More than one-hundred-forty green and hawksbill turtles were caught, ringed, weighed and measured. The first results emphasize the large disparity in growth rates between the species and depending on the sites, most likely due to differences in habitats.


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Using what is called the boat jumping or rodeo technique, consisting in chasing a juvenile sea turtle in a motorised dinghy and catching it on the go, is the only way to carry out individual studies on these species.
Phases of searching (top left), jumping (top right), catching (bottom left) and releasing the turtle (bottom right)

National workshop on **ecosystem** services

A national workshop was organised in the framework of the Europôle Mer SIG on "ecological services: what are the assets for a diagnosis of interactions between society and nature?" attended by forty researchers in March 2010. The presentations and discussions particularly highlighted the relevance of the ecosystem services concept in evaluating the interactions between ecosystems and uses, recommending that local studies be preferred. The brainstorming brought the essential research themes to the fore, with respect to strong expectations and demand in a global context *(Millennium Ecosystem Assessment, The Economics of Ecosystem Services and Biodiversity)* and which exist at different levels.

Governance of coastal **socio-ecosystems**

The objective of the European Spicosa *(Science and policy integration for coastal system assessment)* project consists in helping to solve management problems in coastal areas by promoting the taking into account of scientific knowledge (integrating natural sciences and social sciences) by involving researchers in making public policies. Implementing the system-based approach and building numerical simulation models make it possible to study possible trends in coastal zones and the consequences of alternative management options.

2010 was the final stage in the project, finalising the simulation models and scenarios to be tested, and reviewing and discussing feedback on results within each work study site.

- The Pertuis charentais site studied how fresh water is shared between competing uses on the scale of the Charente river catchment and its coastal zone. The results highlight the interest of institutional innovations in terms of access to fresh water for the main uses, even though, in the initial analysis, oyster farming seemed to be more sensitive to extreme climate conditions.
- The Thau site study further explored the issue of reducing microbiological contamination to preserve the health quality of the lagoon's water. The results pinpointed the better cost-effectiveness ratio of targeted interventions on some parts of the water treatment network and the perspectives provided by measures which are alternatives to the policy of sending all water discharges through the sewerage system, particularly to mitigate impacts on the oyster farming sector.

The manager partners who were associated with the studies on the two French sites approved the system-based approach and the integrated models to assist in management, a useful addition to their current practices which are still strongly sector-based. A new framework is being sought, in partnership with the managers in question, to ensure that the tools developed during the Spicosa project will be transferred.

Monitoring and optimisation of aquaculture resources

Excess mortality in cupped oyster spat: **progress made**

Since 2008, French oyster farmers have been confronted with particularly large-scale excess mortality episodes, from 60 to 90% of young oysters less than a year old, which on one hand are different from the mortality episodes studied during the Morest challenge (a multi-disciplinary study conducted in France between 2001 and 2006 on the "summer mortality syndrome" and on the other hand, do not all show the same characteristics.

During a meeting to sum up the main research results on excess mortality of cupped oyster spat, held in Nantes on 6 October 2010 and attended by fifty scientists from Ifremer, university academics and representatives from Ministries (DGAL, DPMA), CNC, CRCs, hatcheries and technical centres, the main outcomes were presented:

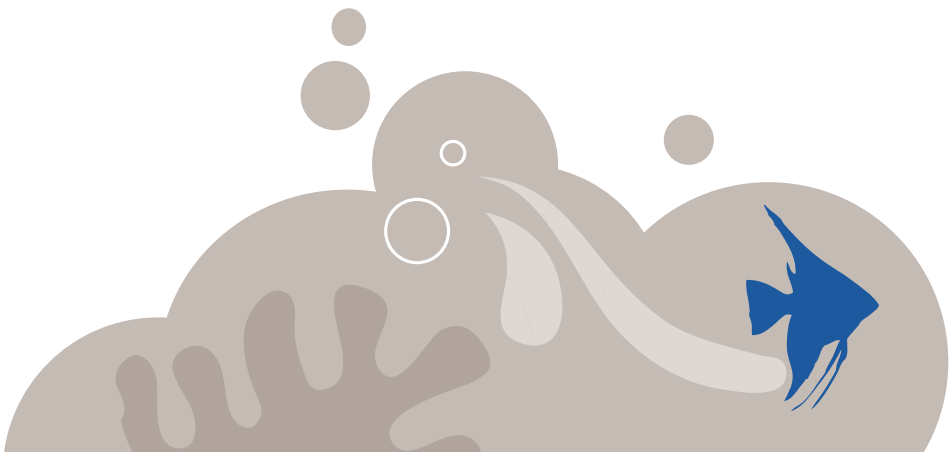
- crossing the temperature threshold of 16-17°C in oyster farm seawater as a trigger for mortality to appear;
- the infectious and transmissible nature of the phenomenon;
- the toxic presence of the OsHV-1 variant of the herpes virus in more or less obvious synergy with vibrios (*V. splendidus*);
- the horizontal spread of the epidemic by currents, affecting wild oysters as well.

The farmed oyster families selected in the framework of the Morest challenge have proved to have greater survival resistance than the control batches of oyster spat studied.

Families selected in 2009 are now in the test phase. Their better survival resistance leaves hope of positive room for progress in the short term.

© Ifremer / J. Prou

Crassostrea gigas *oyster juveniles in the hatchery*



For sustainable **shellfish farming**

The Gerrico "Global management of marine resources and risks in coastal areas" project was mainly conducted from 2008 to 2010, on the study site in the shellfish farming area in the Bay of Bourgneuf. The studies are organised around three main thematic orientations and present significant progress in the fields of phytoplankton production, risk management and modelling of the territory.

Bioproductions and marine resources

Knowledge about phytoplankton production in an estuary ecosystem progressed thanks to the studies conducted, and particularly the approach to quantification and mapping of the microphytobenthos. Simulation of a rise in CO_2 and a drop in the pH of seawater in the laboratory demonstrated diatoms' sensitivity to these variations.

The development of industrial scale photobioreactor to produce fodder microalgae for shellfish or to control toxic phytoplankton is an unparalleled advance.

Identification and analysis of risks for sustainable management

These studies focused on phenomena which are harmful for oyster health. Protection, detoxification and purification processes are clearly of interest for oyster farming activities. Although a sketchy outline exists of solutions for prevention and covering risks, the interactions which have been established between risk management and modelling of the territory provide a wealth of information. For instance, simulations performed using the shellfish farming production model highlighted the negative effects of trophic competitors (crepidula, wild oysters) on reared oyster growth.

Modelling interactions between nature and society

Work in this last theme aimed to create a modelling tool for the territory which includes the different physical, biological, geographical, economic and other compartments. Coupling the compartments is a significant advance in terms of integrating tools to create scenarios and to assist in managing the territory. A scenario including the entire model was even validated, which foreshadows new applications, like offshore shellfish farming or the degradation of water quality, and so on.

© Christiane Blanchard / Gerrico

Oyster farming at Noirmoutier

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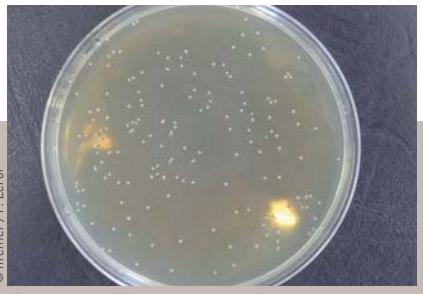
Aerial hyperspectral photograph of the foreshore of Bourgneuf bay



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Colonies of bioprotective bacteria

Spraying a strain of bioprotective bacteria on shelled cooked prawns

Modified atmosphere packaging

Bioprotective bacteria

The market for tropical shrimp is booming in Europe and France, with in particular, a range of ready-to-eat products such as cooked and peeled shrimp which are sold in modified atmosphere packaging. From the microbiological viewpoint, these products are relatively exposed to the development of pathogenic bacteria (*Listeria monocytogenes*) and bacteria which alter their organoleptic qualities (*Brochothrix thermosphacta*).

Ifremer focused its research on a strain of lactic bacteria close to the *Lactococcus piscium* species, selected for its abilities to grow in seafood at low temperatures and for its broad spectrum of antimicrobial activity (tested under model conditions).

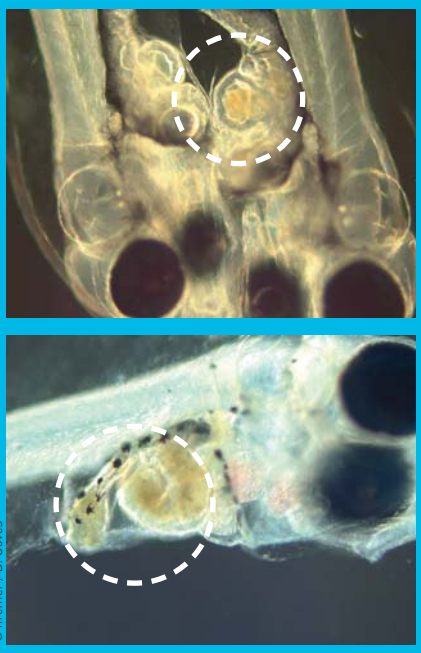
These bioprotective bacteria are capable of preventing the development of pathogenic germs and altering germs in a marine matrix; they do not produce any toxic compound or any resistance to transmissible antibiotics. Using this bacterial strain (under file in the strain collection) could present an alternative to the chemical preservatives currently used by industrial firms. Validations are now being performed on naturally contaminated products.

Domestication of **tuna**

In 2010, the trials conducted by Ifremer on Atlantic bluefin tuna, *Thunnus thynnus*, demonstrated for the first time that larvae were able to ingest microparticles (Gemma–micro 75, Skretting) in alternating co-feeding with rotifers from the time they open their mouths. Examining the stomach content of eight-day old larvae confirmed their ability to ingest inert food. This outcome now opens the way to this feed alternative, which will ultimately enable the nutritional requirements of tuna to be covered from the first days of its exogenous feeding life.

Farmed fish feed, a global challenge

Optimising the feed for farmed fish was studied in the framework of the European Selfdott study on domesticating tuna. Feed based on producing live prey (rotifers and Artemia) represent a hefty budget constraint and a significant risk factor during the early stages of producing marine finfish juveniles. Replacing live prey by compound feeds in the form of microparticles is a major global challenge. Knowledge acquired over the past decade has already enabled live prey requirements to be significantly reduced in numerous species.



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Tuna larvae at different stages

Fisheries resources, sustainable exploitation and development

First deployment of the DPMA's **fisheries** portal

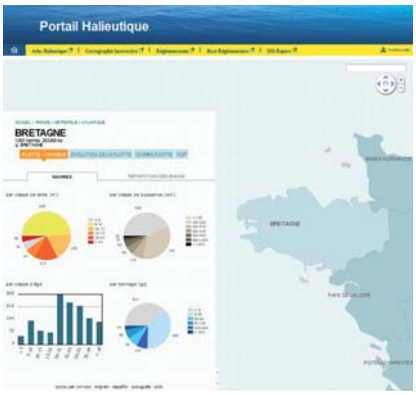
In the framework of the Barnier Plan, Ifremer is taking part in the setting up and operation of the DPMA's "Fisheries and Regulations" Geographic Information System (GIS) in its second phase (mid-2009-mid 2011).

The information system's objective is to make fisheries data related to all French fisheries available to administrations, professional fishers and the general public: its geographic scope, with respect to the areas of activity for the French fishing fleet, is global.

The fisheries portal developed for DPMA is a tool for knowledge, management and information about French fisheries activity. It can also be defined as a decision-making tool for the sustainable management of resources. On the portal, fisheries and fisheries science data (SI Pêche and FIS) and general regulatory information is made available, especially in the form of maps and atlases, based on the geo-referenced data provided by the DPMA's fisheries information system.

The project is based on existing observation and information systems (principally the inter-ministerial SIPA system and Ifremer's FIS Fisheries science information system, as well as on the MNHN's PecheKER and the IRD"s Sardara databases) and aims to ensure that the data are consistent and then disseminate them as maps: aggregation and geographical indexation of fisheries data, digitization and integration of fishing grounds which are regulated within the GIS, producing geo-statistical analyses and spatially distributed indicators, put into on-line atlas form using consolidated fisheries science data.

Access to the system is controlled, with several defined user classes. The tool proposed can provide global dissemination. The fisheries science portal is currently deployed at DPMA, MEDDTL and AAMP.



Indicators concerning fisheries fleet registered in Brittany

Pelagic and planktonic mollusc

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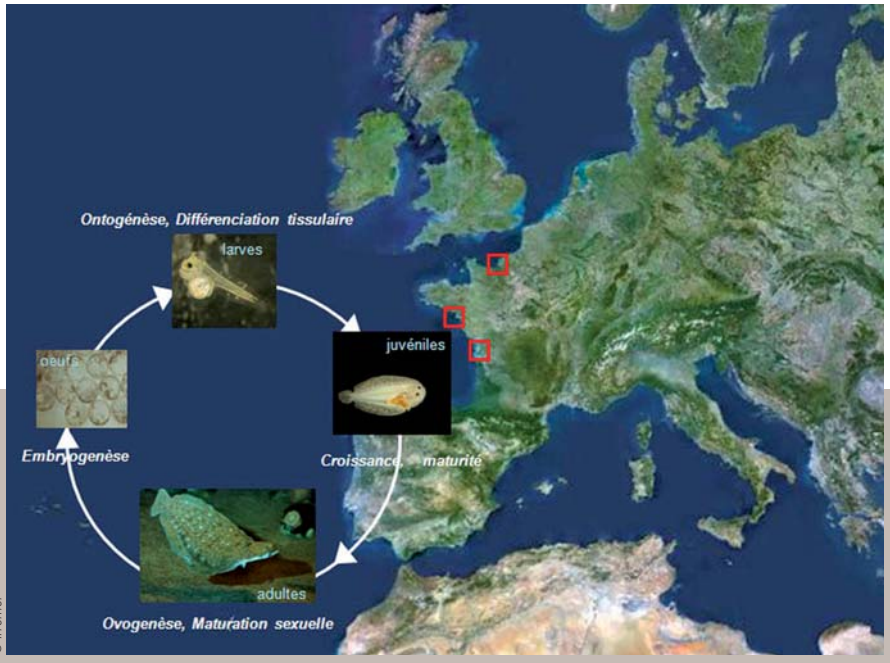
Fate and effects of organic **contaminants**

The study falls under the study issue developed in the ANR-VMC framework with SoleBEMol (2007-2010), whose main objective was to comprehend the fate and effects of contaminants (PCB, PAH and PBDE) on scales ranging from individual to population, in order to predict fish's response potential to chemical contamination. The action is part of a resolutely multidisciplinary approach, which combines the chemistry of organic contaminants, physiology, fisheries ecology, ecotoxicology and modelling. It is broken down into several phases:

- *in situ* monitoring: phenomena of bioaccumulation and biotransformation of three families of organic contaminants (PCB, PAH and PBDE) were studied in sole juveniles from three different nursery zones (Seine, Vilaine and Pertuis charentais) over three consecutive years, from 2007 to 2009;
- experimental strategy: this aspect was based on controlled exposure (via food), followed by monitoring of individuals and controls to measure the medium-term effects. Special interest was given to the fate of contaminants in terms of assimilation and biotransformation. The effects on physiological functions in juvenile stages were studied concurrently: immune and breeding functions are more especially affected by contaminants;
- modelling: a model for the fate of organic contaminants in sole, offering the possibility of taking the effects of these contaminants on physiological functions into account, was created on the basis of a dynamic energy budget model (DEB);

The consistency between experimental observations and simulations confirms that the bioaccumulation is dependent on food and growth. Developing a focused individual model of larval drift from nurseries to spawning grounds based on a hydrodynamic model provided an estimate of larvae inputs to the different nurseries on the scale of the Eastern English Channel. This approach highlighted the fact that the low densities of sole juveniles in the Seine estuary are not due to lower larvae inputs, but can be explained by higher mortality.

Partners: Ifremer (BE/LBCO, BE/LEX, PFOM/ARN, AGSAE, EMH); Agrocampus (Rennes); LPTC (Bordeaux); LIENS (University of La Rochelle).



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The three study zones of Solea solea *common sole nurseries (Seine, Vilaine and Pertuis charentais) in the framework of the ANR Solebemol project*

Deepfishman, deep water fisheries in the North East Atlantic

The objective of the EU-funded Deepfishman project is to take account of the specificities of deep sea fisheries in the North East Atlantic and develop strategic options for managing them. In a workshop situation, participant's knowledge was pooled using two methods, i.e., questionnaires and mind mapping or cognitive maps, to describe different perceptions of how fisheries and ecosystems function. Mind maps are balloon diagrams which can be used to structure ideas in brainstorming sessions and come up with a semi-quantitative summary. The technique made it possible to identify the issues and possible solutions for deep fisheries management in European waters. The stakeholders' perception is that although current management measures for deep sea fisheries are adequate, applying them on a regional scale is not satisfactory. This could be improved through a more regionalised approach to management on the fisheries scale.

Interreg **Charm 3** project

The Charm 3 (Channel Integrated Approach for Marine Resource Management) project's public meeting was held on 31 March 2010. The scientific objectives and developments were presented to an audience of ninety people, including politicians, managers and users of the Channel area. Studies covering the entire Channel as well as the southern North Sea involve a range of disciplines such as marine sciences, economics, legislation, geography, statistics, conservation and IT, working to develop an ecosystem-based approach on the seafront. This multidisciplinarity led in particular to creating a laboratory in 2010 which is specialised in food web modelling and whose analyses will supply data to models (Ecopath and Osmose), as well as to studies underway on spatial planning in the Eastern English Channel (Marxan model), notably involving two PhD theses in collaboration the University of Kent and the University of sciences and techniques in Lille.

Biscay project

In 2010, Ifremer fisheries technology specialists performed a cruise to test a trawl fitted with three complementary devices which had already been trialled separately in 2009. The combination of them takes account of the very different behaviour of fish and Nephrops. The grid, apart from giving Nephrops and small fish the possibility to escape, creates an obstacle for fish and increases the efficiency of the square-mesh cylinder positioned above it. Because it acts as a deflector or spoiler, it also helps small Nephrops escape through the square-mesh belly panel. The results show an escape rate of 46% of Nephrops and 46% of commercially undersized hake. This escaping of hake is in addition to that observed through the square-mesh panels used in commercial trawls and in the control trawl. Trials on alternative techniques (Nephrops pots and fish traps) also continued with the professional fishers in the Bay of Biscay, in particular though the Prespo and CPER Sustainable fishery projects.

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Deploying the combination of three selective devices: Nephrops grid, cylinder and square-mesh net panel (trawl belly) for Nephrops

Fishing gear **selectivity**

Various trials were conducted in partnership with professionals in 2010 on selective gear with the ambition of achieving highly significant reductions in discards of small fish and Nephrops prawns, which remains an important issue in the Bay of Biscay. The method used is to experimentally test the selective systems aboard RV *Gwen-Drez*, in order to choose those with the best performance, and then test them aboard professional fishing vessels in the frame of the "Sustainable fisheries selectivity" programme steered by Aglia.

Channel-**North Sea**

The EU-Norway agreements signed in December 2008 required the rapid implementation of selective devices for cod in the North Sea and Eastern Channel.

At the request of DPMA and of professionals from Channel-North Sea small scale and high seas fisheries, CNPMEM and CRPMEM Nord-Pas de Calais-Picardy, in 2009 and 2010, Ifremer contributed to studies on the various selective devices. Several types of semi-rigid grids or combinations of grids were tested, as were trawl nets with a very large mesh size.

Generally speaking, the devices aiming to reduce (or eliminate) cod catches, without influencing the fishing of other species, were not satisfactory, due to the very high escape rate of other commercial species. For instance, saithe behaves in much the same way as cod, and therefore will escape under the same conditions. This confirms the trials conducted by Cefas in 2009 using the *Eliminator trawl*. Acknowledging this also shows the limits of technical measures in some cases.

The best results for whiting were obtained using a grid with bars set 23 millimetres apart which had already been tested in 2009, in combination with a square-mesh panel positioned above it, where at least 43% escape was achieved. However, a similar proportion of escape was also noted for fish of small commercial size, between 27 and 35 centimetres. The continuation of studies on whiting selectivity, with professional fishermen is planned in order to test other devices experimented in the Bay of Biscay. The objective is to design a technical "tool box" in which fisheries professionals can pick and choose, depending on their needs and on changes in technical regulations.

Exploration and exploitation of ocean floors and their biodiversity

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Rock dredger brought aboard L'Atalante*'s deck*

Databasing of marine geoscience data

An inventory of data acquired by Ifremer's Marine geoscience department on the continental shelf of metropolitan France was launched in 2007, in order to take stock of current knowledge. The report summarises the outcomes of the projects on "Cartographic benchmarking" and "Morphosedimentary nature and trends". The inventoried and databased information covers 87 cruises, i.e. 270,000 kilometres, giving rise to over 8,100 profiles.

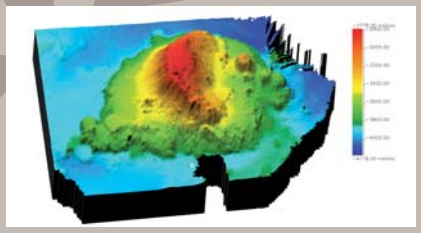
Concurrently, a compendium called the Sextant guide for writing metadata was published. It aims to define a single format within Ifremer for the writing of metadata in the layers that will be loaded to the Sextant server. The guide ensures compliance with the ISO19115 standard and an upcoming version will be compliant with the Inspire directive.

SHOM-Ifremer agreement

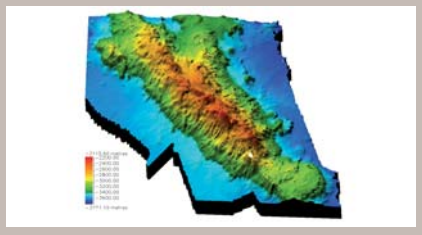
SHOM and Ifremer possess broad bathymetric coverage of the French maritime area, extending from the coast to the deep seafloors. Together they are developing a joint initiative to produce digital elevation models (DEM) which combine their respective data and know-how.

At the end of 2010, Ifremer and SHOM finalised an initial agreement to publish benchmark DEMs for the Channel, Atlantic and Mediterranean seafronts.

Ifremer also coordinated the creation of a digital terrain model with a grid step of 100 metres for the Mediterranean and Corsican seafronts. This follows suit from a similar product for the Atlantic and Channel seafronts. These models are open to all Ifremer users in-house, via the Sextant data server.



Wallisplac: submarine volcano off Wallis



Ocean ridge (Wallisplac2)

Mapping the **Gulf of Lion** seabed

Taking inventory of the available data for the continental shelf showed both the interest and the possibility of launching a summary of the types of seabeds in the Gulf of Lion by compiling over nine hundred profiles. The mosaic formed provides a reference document. It must be interpreted in the form of a surface sediment map for habitat maps (biodiversity) and hydrosedimentary models (pollution). This work is being done with support from MEEDDM, and will deliver a tool to help decision-making by State services (MSFD) and for setting up industrial projects.

Wallisplac cruise

This cruise (aboard RV *L'Atalante*, from 26 September-10 October 2010) aimed to acquire underway geophysical data (multibeam echosounder, magnetism, gravimetry and sediment sounder) and to perform a few dredge hauls (rock samples) in order to draw up a claim for the extension of the continental shelf off Wallis and Futuna, as provided for in the United Nation Convention on the Law of the Sea (Montego Bay, 1982). Detailed mapping of Robbie Ridge, north of Wallis, revealed the continuity of the subsea relief, which extends across the Exclusive Economic Zones of Wallis and Futuna, Tokelau and Tuvalu. The location of the foot of the slope, which is an important criteria for the continental shelf extension and which had been established earlier on the basis of older data in the Geodas database, was confirmed. The magnetic anomalies observed north of Robbie Ridge run in an East-West direction, which is contrary to some previously published interpretations.
Thanks to the presence of representatives from Tuvalu and Sopac (Pacific Islands Applied GeoScience Commission) aboard, preliminary discussions were held on regional cooperation on this subject of importance for access to marine resources in the Pacific islands.

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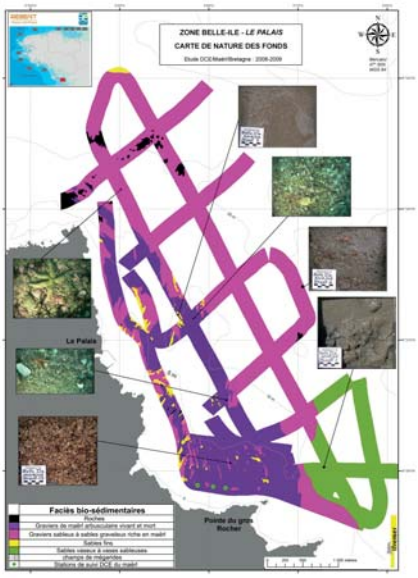
Dredging at night during Futuna cruise



Detailed maerl habitat in Southern Brittany

Cartographic survey of **maerl beds**

In the framework of the WFD monitoring programme, ten sites containing maerl beds located in nine water masses around Brittany were selected from those in which the IUEM in Brest is monitoring biodiversity. The study described the morphosedimentary environment of the stations where maerl habitat biodiversity is being monitored and specified the size and status of the maerl beds targeted in the WFD context. The surveying methods used were firstly a general sidescan sonar flyover, followed by underwater video and grab sampling of the sediment in order to qualify the acoustic facies. Additional means in the form of vessels (RV *Thalia*, RV *Neomysis* and survey boat *Haliotis*) in particular, allow access to beds located at various depths, in very shallow water (especially in the bay of Brest).

A **modelled** Mediterranean habitats map

The Euseamap project was developed for the DG/Mare Emodnet programme and carried to completion with the production of a modelled map of seafloor habitats in the Western Mediterranean Sea. The map delivers estimates of benthic biocenoses based on the physical parameters which are characteristic of their habitat. First, environment data were compiled. For bathymetry, digital elevation models available in the three European countries of the basin were assembled, with a resolution of 250 metres. Maps showing the types of seabed, at a wide range of scales, were assembled and then simplified using a nomenclature of seven sediment classes. Statistics were generated for the variables of light penetration and energy at the bottom (currents and waves) required to define the EUNIS European habitat classification levels. Climatology information for them was obtained respectively from satellite images and hydrodynamic models.

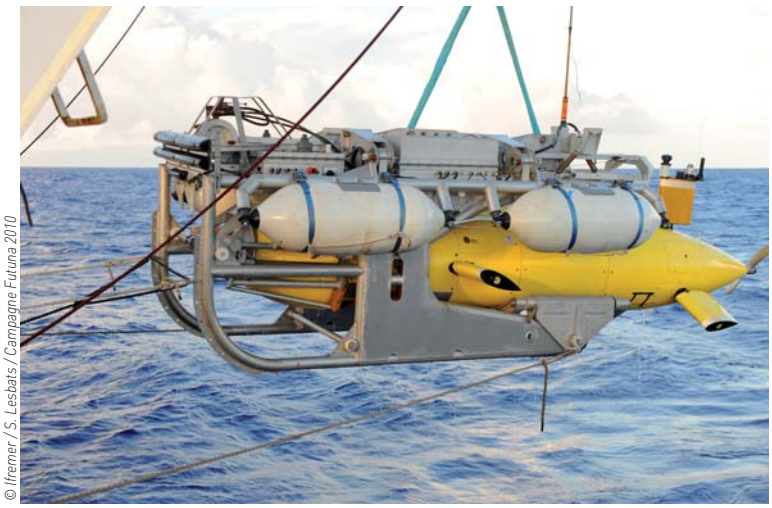
MINERAL AND ENERGY RESOURCES AND DEEPSEA ECOSYSTEMS

Locating mineral resources

Amongst the objectives related to this issue, it is important to begin by locating the active and/or inactive hydrothermal systems and study sulphide mineralisation and associated fluids. Previous exploration carried out by France in South West Pacific back-arc basins, as well as recent investigations conducted by international teams along with knowledge about fossil sulphide deposits all show the scope and diversity of hydrothermal manifestations in back-arc basins. Around the hydrothermal systems on ridges, the input of metal-rich magmatic fluids has been demonstrated on several sites. The French *Alauf* research cruise (geophysics and mapping) performed south of Futuna in 2000, showed an active volcanic ridge to the west of the island and recent volcanic zones to the south and the east. Fluid systems, hydrothermal sulphide deposits and biodiversity in the Wallis and Futuna zone have never been explored before now.

"Futuna 2010", a novel partnership

An agreement was signed by Ifremer, Areva, Eramet, Technip, BRGM SA and AAMP for the first exploration of the French EEZ (Wallis and Futuna) zone by MEEDDM. The Futuna 2010 cruise (3 August-23 September 2010) aimed to specify targets of interest in terms of hydrothermal activity and biodiversity in order to prepare further special cruises. The cruise was made aboard RV *L'Atalante* and using underwater vehicles (*Nautile*, AUV *Aster*[x]). Through it, a vast recent volcanic zone was discovered (new ridge, new volcanoes) and several active (metallic sulphides) and inactive (manganese oxides) hydrothermal deposits were located.



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Recovery of AUV Aster[x] *aboard RV* L'Atalante

Sustainable exploration and exploitation of mineral and energy **resources**

Institute Carnot Edrome research focuses on marine mineral resources (aggregates, nodules, sulphide deposits, crusts, and so on), energy resources (oil and gas, marine renewable energy sources) and deep sea ecosystems. Exploiting this wealth of resources is a major challenge, requiring the best estimation of the potential of all these reserves which is based on thoroughly understanding the phenomena which have led to their genesis and location. Reliable, high-performance equipment and facilities must be developed to produce them sustainably and economically. Natural hazards or those related to human intervention are assessed for human safety and protection of the environment, which corresponds to a significant demand on the part of society. Responses based on results that are supported by arguments must be provided.

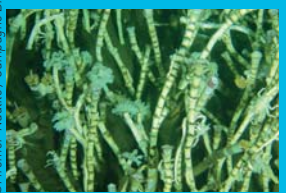
In this context, the Institute Carnot Edrome's objective is to develop the knowledge, tools and methods required to explore and quantify processes on the continental shelf and margins and to sustainably exploit these resources.

The Institute Carnot Edrome was approved for the 2006-2010 period, and presented its scientific report to the ANR, covering fulfilment of the objectives set when it received its seal of approval, in the frame of developing partnership based research.

A broad public-private partnership was established to benefit research actions. Likewise, the seal approval contributed to professionalizing the teams through compliance with the Carnot charter and the best practice guide. The corresponding additional monies contributed to scientific sourcing for teams, developing new methodologies and research tools and hosting of foreign researchers.

BIG cruise in three legs

- bathymetric surveys (Multibeam echosounder on AUV and shipborne MBE) and exploration (seven dives by *Nautile*) performed in the two study zones, i.e. the hydrothermal zone in the Southern depression of the Guaymas basin and in the cold seep zone on the Sonoran margin;
- Sonoran margin cold seep zones study: measurements were taken *in situ* (deployment of deep sea DPMS micro-profiler and Calmar benthic chambers and Chemini chemical analyser measurements) as were samples (cores, fluid and fauna specimens) needed to characterise the biological communities (fauna and microorganisms) and their environment. Four habitats were studied and a Kullenberg core sample (8 metres) will yield information about the processes (microbial community diversity, chemistry) which take place in the deep sediment;
- hydrothermal site study in the South depression of the Guaymas basin and the same strategy of *in situ* measurements and sampling was applied to the four habitats chosen.



Siboglinidae bearded worms in cold seep zones on the Sonora margin

Riftia pachyptila *giant tubeworm bush and microbial mats on active hydrothermal sites*

Colonization modules deployed on microbial mats. Temperatures can reach 120°C at twenty centimetres deep in the sediment

Biodiversity and interactions at Guaymas

The BIG cruise (RV *L'Atalante* with *Nautile* submersible and AUV, from 31 May to 9 July 2010) brought together a multidisciplinary research team of thirty scientists, engineers and technicians including biologists, chemists and geologists.

There were three legs to the cruise which took place in the Guaymas basin, located in the Gulf of California off Mexico. The originality of the Guaymas basin is that over a limited geographical area, having the same sedimentary substrate, it features hydrothermal sites and cold seep zones. In these two environments, the characteristics of subsurface networks lead to the formation, at the interface of a mosaic of habitats which are visually obvious (microbial bacteria mats, assemblages predominantly made up of bivalve molluscs, siboglinidae bearded worms, etc.). This made it possible, on the same cruise and in a relatively small geographic zone, to implement an approach to compare hydrothermal (microbial and animal) communities with cold seep communities, in a sedimentary environment.

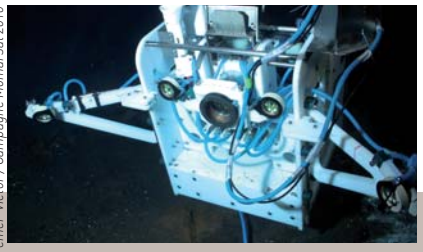
Seafloor **observatories**, demonstration missions

The Esonet network of excellence, coordinated by Ifremer, supports the development of multidisciplinary seafloor observatories. Three demonstration and testing missions were organised by Ifremer on high priority sites for French research in the major EMSO (European multidisciplinary subsea Observatory) infrastructure: the North Anatolian fault in the Ligurian Sea, the Marmara Sea and hydrothermal sites in the Azores.

On the Antares site of the astrophysical neutrino observatory south of Porquerolles, during the Texrex cruise in November 2010, Ifremer set up a secondary junction box (SJB) interface for communications and power distribution. It enables oceanographic instruments to be hooked up to the wired infrastructure for long term monitoring of this site or for trials. CNRS INSU and LMGEM are its first users, for biogeochemical (instrumental interface module or IIM) and seismics studies.

Several ocean research cruises took place in the Marmara Sea in the framework of seafloor observatory development (EU programmes Esonet and EMSO). A cabled array should be set up in this zone to study natural hazards which threaten the district of Istanbul.

The Pirmarmara cruise carried out on the Turkish research vessel *Piri Reis* in June 2010, made it possible to acquire a set of long offset (1,500 metres) high resolution seismic data to supplement the 3D data from the Marmesonet cruise (RV *Le Suroît*, November 2009). These data will be used to determine the propagation velocity model needed for 3D imaging. Analysis of OBS data revealed the existence of non-seismic micro-events, most likely related to natural degassing processes on the seabed.



The Tempo observing module and its video camera monitor fauna at the hydrothermal edifice named the Eiffel Tower over several months

The geophysical node was moored in the centre of the lava lake which is characteristic of the Lucky Strike hydrothermal field for observations

A technological **feat**

One of the first seafloor observatories was installed during the Momarsat ocean research cruise (1st -16 October 2010), jointly conducted by Ifremer and the Earth physics institute in Paris (IPGP). It now transmits its data (physical-chemical conditions, seismic activity in the zone, etc.) daily to the Ifremer centre in Brittany. This technological feat involves several European research institutes in the framework of the Esonet network of excellence.

Its main objective is to observe the hydrothermal vents in the Lucky Strike field on the Mid Atlantic Ridge off the Azores for a period of almost one year, to prepare for the long term observation planned in the EMSO infrastructure framework. The knowledge acquired will provide better input about the functioning of this exceptional geological and biological assemblage, which has been an Ospar marine protected area since 2006.

Researchers will continuously monitor, over the entire duration of the immersion, variations in temperature and physical-chemical conditions and seismic activity in the zone and will observe the highly unusual fauna of hydrothermal vents in action. The observatory will be operational during one year and will be recovered in summer 2011 at the earliest.

Tsunami surveillance

The Ratcom (tsunami warning system for the Mediterranean coasts) project, coordinated by Thales Alenia Space, aims to develop a near-field warning system for coastal submersions and tsunami risks. It is based on two major functional components: an up-link instrumental branch collecting data on land, at sea and in the subsea field and a down-link component to disseminate secure warning messages from a data processing centre.

Ifremer is responsible for prototyping the underwater installation of seafloor sensors (piezoelectric pressure sensor type) and installation of a seismographer connected to the Antares seafloor observatory off Porquerolles at a depth of 2,500 metres. To supplement this real-time processing, decision-making tools based on modelling and simulation are being developed and made available to those bodies responsible for crisis management and intervention. Ifremer contributed, with CEA, to modelling the zones where tsunamis are generated.

The project made it possible to validate at sea the operation and installation of an innovative system to deploy the array in "sleep mode" (only activated on command or by a natural event), linking communication nodes which are several tens of kilometres apart and themselves linked to underwater sensors. The novelty of the Deepseanet architecture lies in its optimised manufacturing and deployment costs. "Low cost" underwater optical connectors, low consumption smart electronics for array management (activated by optical signal *via* the fiberoptic microcable linking the nodes) and deployment on a skid moved by a ROV (no need for a cable layer vessel) are the main innovations, for which patents have been filed or industrial licence agreements signed.

Noise hazards for the marine environment

Ifremer is involved in actions to assess and monitor the good environmental status of the oceans, and noise pollution is one of its components. Environmental noise hazards engendered by human activity must be assessed, as must the noise-generating activities conducted during our Institute's ocean research cruises. Moreover, Ifremer is taking part in defining and establishing the estimation of descriptors (loud noises, noise from shipping, etc.) related to the acoustics strand of the Framework Directive for monitoring of the marine environment. Finally, the emergence of marine renewable energy technologies raises the issue of assessing noise disturbances caused by their installation at sea. The first *in situ* measurements performed by NSE/AS around a tidal stream turbine prototype clearly demonstrated the interest of such verifications.

Taking account of noise hazard for marine mammals is now an integral part of the routine for experimental procedures conducted by Ifremer at sea. Studies to predict the impact of acoustic systems (seismics sources) have led to the defining of protocols to control risks, from the scheduling of operations to the checking of emissions in the field. Several technological developments have been created to support this self-regulatory approach (very similar to those of the offshore industry and Navies). A passive detection system of sound signals emitted by cetaceans was designed for vessels performing noisy activities. Other acoustic deterrent devices to repel them are also being developed or tested. These tools were originally intended to prevent accidental by-catches of cetaceans in fishing gear, and can be applied to noise risk management. They have proved effective for dolphins and must now be adapted to other species.

More environmentally-friendly **paints**

The Ecopaint "non-toxic, drag reduction antifouling coatings" project is coordinated by ISITV in Toulon and conducted in partnership with the DCNS naval shipyards and the Blancolor company. Paintclean "environmentally friendly antifouling paint" is a project coordinated by the Nautix firm and carried out in partnership with the University of southern Brittany (UBS), IPL sustainable health environment labs and DCNS. Both projects have been approved by the Brittany and PACA marine clusters.

Studies conducted at Ifremer focused on both assessing the effectiveness of coatings and the potential ecotoxicity of active ingredients, followed by formulations. In Europe, risk assessment is done in compliance with the *Technical Guidance Document* (1998) for the marine environment. It is performed on six levels of the food web (bacteria, plankton microalgae, crustaceans, molluscs, echinoderms and fish).

Two of the most interesting formulations in each project were also tested *in vivo* on adult oysters exposed for a little over ten months in cages placed on the foreshore in the Finistère region, with the objective of assessing the resistance of the paints as well as their impact on oysters (mortality, growth, gametogenesis, etc). The results obtained in 2010 made it possible to rank the active substances and formulations in terms of their ecotoxicity, for both projects.

Evaluating the effectiveness of paints carried on various sites in collaboration with the two consortia led to establishing a joint protocol on "assessment of antifouling efficacy of release active coatings in the framework of trials of submersion in natural environment on experimental barges-Adaptation of NF T 34-552 standard", which will be submitted to ANSES for the European working group's work on the Biocidal Products Directive.

A national **MRE** platform

The French State put the creation of an institute of excellence in the field of carbon-free energies (IEED) on the list of developments to be financed by the National loan. The IEED project called "France Énergies marines" sponsored by Ifremer is located in Brest. It is strongly supported by the Marine competitiveness clusters, academic and scientific institutions, industrial firms and local and regional authorities, with the regional councils of Brittany, PACA and the Loire region leading the way. 2010 was mostly devoted to preparing the submission, planned for early 2011.

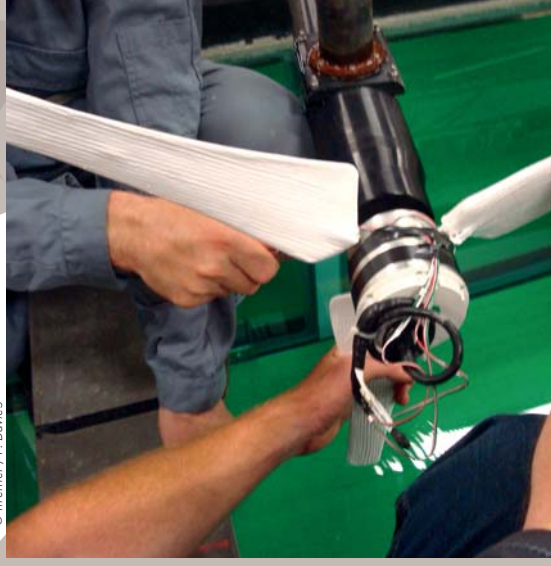
MREs, a sector creating jobs

In terms of marine renewable energy sources (MREs), France enjoys both huge natural potential is huge, both in metropolitan and overseas France, and sound scientific and industrial foundations in the maritime and power sectors. What is at stake in economic terms is the development of a supply chain which will create jobs and which can establish itself on the world market. "France énergies marines" thus embodies the will, as expressed by State authorities in 2009, to create a national MRE technological platform, intended to support this ambition. The proposed structure is the result of partnership-based dynamics beginning with demonstration projects at sea for different types of energy recovery systems and with foresight study approaches to identify market trends, technological barriers, criteria for environmental integration and compatibility of uses.

Durability of **composite** materials

Composite materials are the perfect solution to meet the needs of the MRE industry in building their structures, because they are corrosion resistant, lightweight and have very good mechanical properties. To this end, Ifremer started a study on the fatigue performance of submerged composite structures, with the manufacturing of tidal turbine blades particularly in mind. In the framework of an industrial partnership with three fibre and resin suppliers (OCV, France; 3B, Belgium and Hexion, Germany), a PhD thesis study was undertaken and defended. The behaviour of different materials was studied and the effect of fatigue in the marine environment was characterised.

The study provided an initial basis for designing the durability of tidal turbine structures. In addition, knowledge about loading and specific transport of this type of structure was addressed though trials in the current measurement test tank in Boulogne-sur-Mer on instrumented blades and by numerical modelling of behaviour. This research falls under the framework of studies to estimate the fatigue damage on marine structures subject to complex loading (several wave systems superimposed on wind and currents).



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Preparation of trials for marine current turbine instrumented composite blades

BIOPROSPECTION AND DEVELOPING VALUE OF BIOLOGICAL RESOURCES

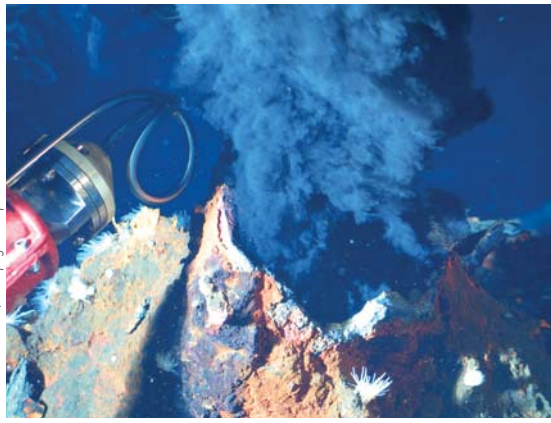
Microorganisms of **extreme** environments

Within the project on Thermostable proteins/enzymes, Ifremer studied the molecular and biochemical mechanisms which maintain the genome of a hyperthermostable Archaea. Specimens of this organism (*Pyrococcus abyssi*) were taken at hydrothermal smoker at a depth of 2,000 m in the North Fiji basin. Its optimal temperature for growth is around 95°C.

Studying the members of this family of hyperthermophilic microorganisms holds promise for acquiring fundamental knowledge and discovering biotechnological applications. Since the first complete *Archaea* genome was published, replication and maintaining genome integrity in this third domain of life has become a very active field of research. The field is mostly occupied by American, Japanese and European groups which are closely linked to industrial firms involved in developing products for molecular biology techniques.

In the framework of the ANR Archpol funding for young researchers, studies focused on the functional characterisation of two DNA polymerases from *Pyrococcus abyssi* : Pabpol B (MP Biomedicals company) for PCR applications, and Pabpol D which is patented. Compared to AmpliTaq Gold® (Applied Biosystems) Pabpol D in routine genetic fingerprinting laboratory simplex and multiplex PCR assays, can amplify the DNA fragments more significantly in both simplex PCR and multiplex PCR assays. This enzyme could be very interesting for applications in the fields of genetic fingerprinting an molecular diagnosis as well as for studying old DNA.

In addition, in the context of ANR Blanc Arcrep funding, research on new factors in maintaining the genome in *P. abyssi* enabled Ifremer to characterise an RPA protein showing a very strong affinity for single strand DNA. Molecules produced by hyperthermostable organisms, like the RPA of *P. abyssi*, remain active even after incubation at temperatures of 95°C. They can be used in the context of applications which require extreme temperature conditions such as amplification or sequencing of DNA. A patent to protect the various applications for this molecule was filed. Tests are being made in order to use the RPA molecule to preserve DNA and RNA at room temperature, since the conservation of nucleic acids is a problem seeing the large number of samples which must be stored in the cold.



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Hydrothermal smoker

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Biofermentation

Glycobiology, collaboration through networking

Glycobiology focuses on the structure and function of complex sugars or glycans. It is a new field whose spin-offs in the realms of health, agrifood and biomaterials are booming. Carbohydrates or sugars (polysaccharides, oligosaccharides and glycoconjugates) are a class of highly diverse, renewable molecules with physical, biological and chemical properties which are very different from other molecules like proteins, lipids or nucleic acids. Research in this field requires special and novel know-how, which is found in several of the Ifremer laboratories in western France (Brittany and Loire region). The objective of the "GlycoNetWest" network is to coordinate the research efforts of the teams in Brittany and the Loire, to integrate the tools and skills present in the regions and to take advantage of the complementary nature of multidisciplinary approaches. The network is jointly coordinated by the University of Nantes and the Roscoff biological station and will contribute to ensuring that knowledge in glycobiology progresses and will be transferred, for applications in medicine, food sciences and renewable biomaterials.

Applying marine **biotechnologies** to pearl farming

Phenomena of nucleus rejection and mortalities, which can affect up to 30% of pearl oysters in the first three weeks of the post-operative period, seem to be due to infectious pathologies or inappropriate grafting practices. The development of an inflammatory reaction or sepsis following the insertion of the nucleus and contamination by pathogenic bacteria, combined with the lack of rapid healing of wound tissues are most likely the main causes of nucleus rejection. Moreover, to produce a good quality pearl, the surface of the nucleus must be as smooth as possible.

© Ifremer / Y. Gueguen

Pearl oyster Pinctada magaritifera

Studies carried out on coating the nuclei demonstrated the potential of biopolymers (exopolysaccharides and polyhydroxyalkanoates) in association with natural antimicrobial peptides to form a homogeneous film with antibacterial properties. Use of these coated nuclei should thus reduce the nucleus rejection phenomenon as well as slightly improving the quality of the pearl obtained. The results are both due to the biopolymers making the surface of the nucleus more homogeneous (limiting surface irregularities) and to the presence of bactericidal peptides in the coating. Furthermore, these biopolymers could also reduce bacterial adhesion and bacterial growth for optimal placing and development of the pearl-sac around the nucleus.

Ocean circulation and marine ecosystems, mechanisms, trends and forecasts

The "Dynamics, ocean biogeochemistry and climate" programme contributes to theme 1 in Ifremer strategic plan, i.e. "learning about ocean circulation to supplement the diagnosis of global change". This involves determining coupling between ocean circulation and climate change on various scales of time and space, including studying the processes of exchanges between the shore and offshore. The chosen approach combines ocean observation, data analysis and modelling to better understand the processes.

© Ifremer / Ovide 2010

Deployment of a Provor float (Argo project)

The North Atlantic is getting **saltier**

The Ovide project is conducted by Ifremer and began in 2002, with the aim of studying the variability of the North Atlantic Ocean to better understand its impact on the climate. Its fifth and final cruise, which took place in June-July 2010 aboard RV *Thalassa* showed the salinisation of water masses observed along the Ovide leg between 2002 and 2010.

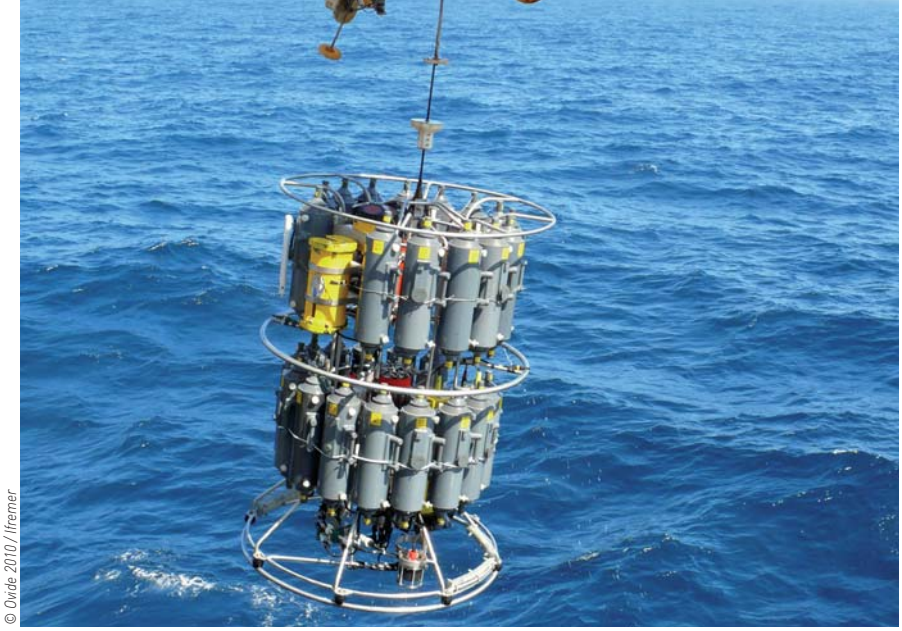
Water in the Labrador Sea was more saline in 2010 than at the start of the decade. Between the 1990s and the years 2000, the property of Labrador Sea water changed, and atmospheric conditions were different over the two periods. In the 1990s, atmospheric conditions favoured the formation of very deep, very cold and hardly saline water in the Labrador Sea. On the contrary, in 2000 and on, the water formed in the Labrador Sea became warmer, more saline and shallower. Once it is formed the water from the Labrador is transported by currents. It takes a few years for it to cross the path of the section performed by Ovide. Thus, the signature of these changes in properties is found in the data collected.

The trend of increasing salinity observed until now in waters located at depths between 0 and 500 metres south of Iceland (called Reykjanes mode waters) is ongoing. Since this water mass is also transported by currents all around the basin, a saline anomaly is clearly visible in the boundary current along Greenland. The salinisation can be explained by the larger input in the Iceland basin of water coming from the tropics.

Surface water masses in the Iceland basin are mixed with a deep water mass from from seas in Scandinavia, called Iceland–Scotland Overflow Water (ISOW). This water mass circulates deeply around bathymetric structures like the Reykjanes Ridge. Since the surface waters in the Iceland basin are warmer, the ISOW observed on the western flank of Reykjanes Ridge is clearly more saline in 2010 than in 2002.

It is likely that this increased input of salt in the subpolar eddy has an impact on the intensity of the formation of water masses and their properties, on the intensity of the North Atlantic subpolar eddy circulation and, in fine, on the carbon cycle. However it is still too early to precisely determine the nature of this impact.

Cooperation with: CNRS, University of western Brittany, Roscoff biological station, Instituto de Investigaciones marinas de Vigo (Spain), Shirskov Institute of Oceanology, Moscow (Russia), National Oceanography Centre of Southampton (United Kingdom).



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CTD deployment

Very high **resolution** Ocean

The "Very high resolution ocean" project is one of the priorities in theme 1 of Ifremer's strategic plan. Its purpose is to understand the influence of small-scale phenomena on ocean circulation. It revolves around the exploitation of data from the latest generation of satellite sensors to analyse the ocean surface layers and of geoseismics data in the water column to study mixing in the ocean interior.

The project is mainly based on numerical simulations performed by Ifremer on *Earth Simulator 2* using numerical modelling developed by Jamstec (2009-2013 partnership).

Test done on the Kuroshio current in the North Pacific, combined with results already obtained in the North Atlantic, made it possible to validate the 3D method to reconstruct ocean circulation from surface satellite data and realistic modelling perfected by Jamstec.

Analysing the very high resolution simulations performed in 2010 in collaboration with Jamstec scientists showed the great potential of data from future "SWOT-type" very high resolution altimeters (planned launch in 2016-2018). They will be able to reconstitute surface currents as well as vertical velocities to depths of about 300-500 m. This will represent major progress.

Recent geoseismics observations have revealed that the important role played by small spatial scales on energy fluxes is generalised at depths from 500 to 2,000 m. This result was confirmed by very high resolution non-hydrostatic simulations on *Earth Simulator 2*, quantifying transfer of energy on the finest spatial scales.

A session entitled "Submesoscales from Space to the Deep Ocean Interior" was organised at the international AGU ocean sciences meeting in Portland (USA) in February 2010 confirmed and specified the very strong impact of ocean sub-mesoscale structures (from 20 to 100 km) on the increase in the kinetic energy of ocean circulation with respect to scales under 20 km which can contribute to mixing.

Ifremer also took part in organising the workshop on the "Influence of meso- and submesoscale ocean dynamics on the global carbon cycle and marine ecosytems", at the Aber Wrac'h marine centre in June 2010.

Cooperation with: IPSL, Legos, LEGI, Ladhyx, Jamstec (Japan), University of Hawaii (USA), University of California, Los Angeles (UCLA, USA), Courant Institute, New York, USA.

Aspex cruise

The objective of the Aspex cruises is to describe seasonal current in the Bay of Biscay and exchanges between the continental shelf and the ocean abyssal plain. An unprecedented experimental array was designed and twelve moorings (current and hydrology measurements) were deployed in July 2009 on the continental shelf and slope. In 2010, the moorings were recovered after a year of measurement recordings, to be reconditioned and redeployed for a second year.

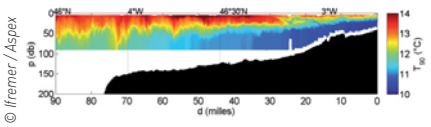
In spite a few of the seabed frames being accidentally displaced by fishing gear, all of the devices were retrieved before autumn. There was an exceptional rate of exploitable data recovered, i.e. about 95% of the maximum possible, due in particular to the design quality of the equipment deployed.

Although the cruise clearly showed some already known features of circulation in the Bay of Biscay, it also revealed new elements such as the presence of a current running parallel to the continental slope, but in the opposite direction. A fine-scale study of the area is now possible, thanks to the wealth of information collected.

After being reconditioned during the summer 2010, all of the instruments were redeployed.

Aspex 2010 also provided an opportunity to perform some hydrology sections (T, S, Fluorescence and turbidity) with high horizontal resolution using the *Scanfish* towfish.

Epigram programme: ENS Lyon, SHOM/HOM, LEGI, Legos, Locean, LOG, LSEET.



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Temperature section measured using Scanfish *towfish device*

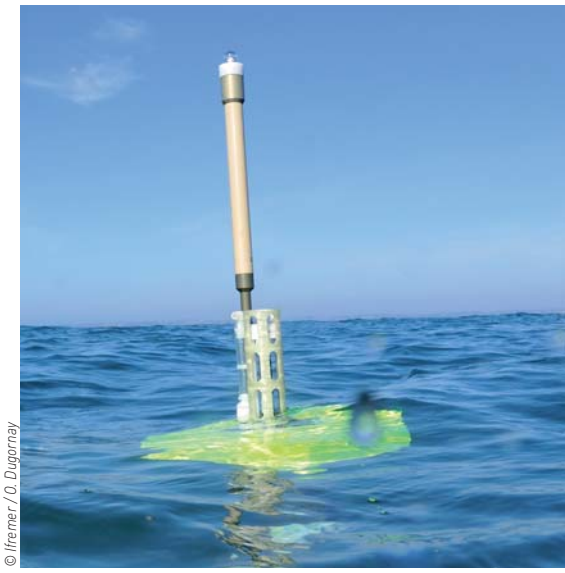
A PUBLIC INTEREST SERVICE ON THE OCEAN

Ifremer's operational oceanography activities aim to develop, in liaison with Mercator Océan, new capabilities for observation (*in situ* and satellite) analysis and forecasting for oceans from offshore to the coast.

Ifremer coordinates the *in situ* component of operational oceanography on French (Coriolis) and European (MyOcean, Euro-Argo) levels. Our institute strongly contributes to developing the use of satellite observations for ocean monitoring and forecasting.

Concurrently, Ifremer is driving the development of French operational coastal oceanography (OCO) through the Prévimer project. OCO delivers modern tools for "integrated" observation of coastal zones, which will enable Ifremer to better fulfil its public service missions (environmental monitoring, living resource management) and its coastal environment research missions. The coastal system prototypes set up (Prévimer) should lead to a future national operational coastal oceanography service (Snoco) interfaced with Mercator Océan.

In 2010, special efforts were made globally to develop *in situ* observation arrays. Studies were conducted in parallel with spatial observations with both the SMOS satellite results on salinity measurements, and the development of new temperature and ocean colour products for environmental monitoring of the French EEZ.



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Arvor C ocean profiling float

Instrumentation of **Argo** profiling floats

The Arvor profiling float being produced at NKE, the industrial partner, is progressively becoming the standard offer for Argo needs (salinity and temperature), where as the Provor profiling float, thanks to its possibility of carrying additional sensors, is being turned towards special (biogeochemical) applications.

The Euro-Argo preparation phase entailed advances in the field of satellite communications. Equipping the float with an Iridium communications device was successfully validated at sea and the first floats will be deployed in early 2011. These floats will benefit from Argos-3 improvements:

- shorter time at surface (30 min. including time emerged for Iridium, instead of 8 to 9 hours for Argos2) particularly in closed seas like the Mediterranean, will enable float-life to be extended (reducing risks of washing up on shore, reducing sensor deterioration from fouling);
- communications capacities (more data transmitted) will enable finer sampling of the water column and the use of new sensors;
- exploiting the two-way link will provide possibilities of remote control for profiling floats: changing the analysis and sampling depths, keeping them at the surface for possible retrieval.

© Ifremer / S. Le Reste

Trials of Arvor float equipped with new Argos3 transmission

Arvor profiling float

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Molit buoy measurement station

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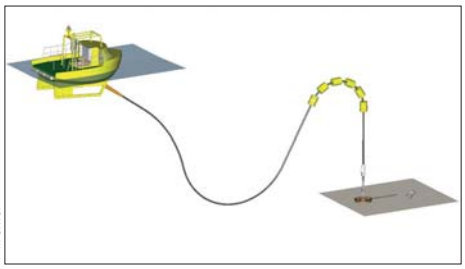
Smatch buoy to measure temperature and salinity

A new generation of *in situ* measurement **buoys**

In 2010, Ifremer pursued development of its high frequency coastal measurement array, with the operational deployment of Smatch buoys located offshore in Brittany (island array) and the Molit buoy installed in the Bay of Vilaine (Marel Vilaine array).

The "island array" (Glénan, Houat, Yeu and Oléron islands) was launched in the early years 2000 in order to validate the MARS3D hydrodynamic model of the continental shelf, and has been adapted to meet Prévimer project requirements. It deploys the new generation of autonomous Smatch_TS buoys, which are like actual small measurement stations fitted with an automaton, batteries, connectivity and temperature sensors, GPS positioning systems and GPRS data transmission. Three of the four sites are operational as of today

The "Marel Vilaine array" was implemented as a pilot for the "Trophimatique" project (WFD), financed by ANR, which reached its term at the end of 2010. Measurements taken very frequently at two levels – i.e., bottom and surface - helped to validate the MARS3D model. Akey element in this array is the Molit buoy (made of steel, six metres long and weighing tons) which is truly a coastal measurement platform. The novel aspect of its technique lies in the hose which keeps it in place, as well as the pumping of water from the seabed and the surface for automated analysis on board (temperature, salinity, dissolved oxygen, fluorescence and turbidity). The data are stored, then transmitted twice daily via GSM to the Coriolis data base. Funding for putting the buoy back in place and keeping it in operational condition is provided by the Prévimer project.



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Operating principle diagram

NAOS, a winner of the Équipex call for projects: preparing Argo's next decade

In 2010 Ifremer and its partners prepared an ambitious proposal called NAOS for Novel Argo Ocean observing System in the framework of the call for tender for facilities of excellence funded by the National loan. NAOS is one of the fifty projects selected. Its objective is to consolidate French and European participation in the international Argo profiling float array and to anticipate how the network can evolve in the coming decade. NAOS will develop the next generation of Argo floats.

They will be more intelligent, capable of carrying new sensors (particularly for biogeochemistry) and to go to greater depths, in order to improve knowledge about the role of the ocean in the climate .

Partnerships: Ifremer, UPMC (co-sponsor), CNRS (INSU), PRES UEB (UBO/IUEM), SHOM, CLS (satellite telecommunications), NKE (marketing French Argo floats).

Fisheries science
and oceanographic research

The Recopesca project is positioned at the interface between fisheries science and coastal and open sea oceanography. Its initial calling was for fisheries, setting up an array of instrumented fishing vessels to collect information about fishing operations (position, duration, and so on). Since these boats are excellent ships of opportunity for scientific measurements, new temperature and salinity (conductivity) sensors were installed on them. Currently about forty fishing vessels are equipped for approximately 250,000 "stations" a year. The data transferred to the Coriolis database regularly supply ocean research.

© Ifremer / M. Repecaud

This concentrator retrieves measurements, integrates the ship position and transmits the data to shore

Ocean **temperature** and colour

Ifremer created an *Atlas of temperature, chlorophyll concentrations and surface turbidity of the West European continental shelf*. The atlas is designed to characterise the baseline state of the French Exclusive Economic Zone for the Marine Strategy Framework Directive. It gives sea surface temperatures and their trends since 1986, mean surface chlorophyll situations from 2003 to 2009 and, for the first time, turbidity. The ocean colour satellite data were validated with observations from twenty-eight coastal stations in the Somlit and Rephy networks. All together, it provides a synoptic view of the environment of the Western European continental shelf, with a regional analysis of the advantages and disadvantages of both *in situ* observation and remote sensing methods. Only spatial methods can provide a full assessment of the continental shelf for the three mapped parameters.

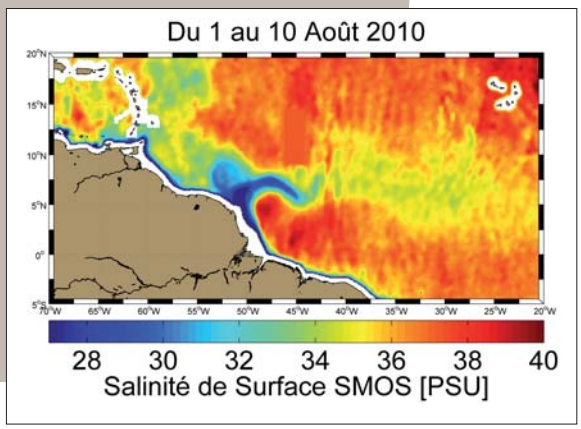
The first results from **SMOS**

The SMOS (Soil Moisture and Ocean Salinity) satellite mission (ESA, CNES and CDTI) was launched on 2 November in the framework of the "Earth Explorers" programme, and has since supplied salinity measurement from ocean surfaces acquired on the global scale. The downstream SMOS satellite data processing centre (CADTS) located in Brest was inaugurated on 15 October 2010. It transforms raw data sent by CDTI into level 3 and 4 products and ensures their dissemination to the scientific community.

After a six month validation phase for the SMOS instrument (January to June 2010), Ifremer's spatial oceanography laboratory presented the first scientific results on remote sensing of salinity at the ocean surface at the international ESA-Living Planet Symposium (Bergen). The first global monthly surface salinity maps were drawn up with an accuracy of about 0.4 psu per 100 km^2 cell.

A demonstration of the instrument's ability to monitor saline fronts was done in August 2010 on the Amazon River plume, showing the rapid changes in freshening over a three month period and its advection (transport) by surface currents.

Surface salinity measured by SMOS satellite and mapped by CATDS. More than 1,000 km from shore, the Amazon river's low salinity plume (blue-green colour)



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Scientific expert assessments

Numerous public stakeholders solicit Ifremer's expertise for diagnoses and advice in various fields related to marine ecosystem management: fisheries, shellfish production, aggregate extraction, maintaining harbour channels and fairways, coastal planning, marine renewable energy sources, protecting sensitive coastal zones, etc.

In 2010, one hundred twenty-seven experts from Ifremer were mobilised to respond to two hundred fifty-six requests from the public sector. Of these, one hundred eleven concerned genetics, pathology and animal health (on the rise); seventy-four concerned fisheries and fisheries ecology (down slightly) and seventy were related to the coastal environment, planning and resources (sharp drop). The latter decrease is explained by the State's reorganisation into coastal subregions, mainly on the Atlantic seafront.

Sixteen expert assessments were also performed for the private sector.

For 70%, public requests came from the devolved State services in the regions. 16% were issued by the central administrations of our supervising Ministries or their agencies and 14% by European or international organisations.

Health monitoring of shellfish production areas

During the first and last quarters of the year 2010, numerous cases of collective food poisoning (TIAC) related to consumption of shellfish had the virology and bacteriology units at the MIC-NRL laboratory holding their breath.

© Ifremer / O. Dugornay

Deploying the trawl aboard RV Thalassa

Fisheries **resource** management

To support fisheries management, the network of fisheries science experts was mobilised to deal with twenty-two referrals from DPMA, some of which were increasingly complex or on new subjects. Interventions related to discharges at sea and by-catches, based on observations carried aboard fishing vessels, provide the basis for work on scenarios for the short- and medium-term management of often-sensitive resources. Outstanding work in 2010 involved:

- consolidation of fishing effort data of French ships by zone and by métier, in order to revise the total allowable catches (TAC) under the long-term management plan for cod set at the last Fisheries council meeting (December 2010).
- developing the Mediterranean management imposed by EU regulations, based on the description of activities (fisheries) and their impact on resources and habitats, accompanied by proposals for monitoring. The stakes of this plan concern the entire Mediterranean coast. As well as trawling, it sets a framework for traditional small-scale *métiers* which use towed gangui gear, dredging and ring nets. It must define a level of use which is compatible with the sustainability of the fished resources the conservation of sensitive habitats (seagrass meadows, etc.).

Finally, Ifremer is taking part in preparing the new Common Fisheries Policy (CFP) by reviewing the concept of catch quotas and its practical implications in terms of estimations and monitoring and more broadly speaking, of fishing rights to be produced.

Shellfish contamination

In 90% of samples received caliciviruses were sought, and in 10% *Vibrio parahaemolyticus*.

66% of the twenty-four samples received for *Vibrio parahaemolyticus* testing were indeed contaminated by this marine bacterium which is potentially pathogenic for humans.

Ninety-four TIAC sources were recorded in 2010 and out of the two hundred four batches of shellfish received following twenty-two referrals from the General directorate for food (DGAl), 69% were contaminated by caliciviruses (norovirus and/or sapovirus).

The norovirus is the most common causative viral agent for acute winter gastric flu epidemics in the population. In the case of malfunctions (in sewage systems or water treatment plants) mainly related to rainfall events, inflows of raw or insufficiently treated wastewater impact the coast. Shellfish can be contaminated.

© Ifremer / J. Prou

Preparing oysters for genetics and pathology studies at Ifremer's station in La Tremblade

Increased mobilisation for marine **mollusc** health

Excess mortalities in *Crassostrea gigas* cupped oysters observed in France since 2008 led to a clear rise in the number of expert assessments and opinions produced by the EURL for mollusc pathology in La Tremblade during the year 2010 (110, i.e. + 20% from 2009). The analyses did not only involve histology investigations for infectious agents which must be reported, but also looking for bacteria from the Vibrio genus and the OsHV-1 virus using molecular techniques. Two significant contributions can be mentioned:

- real-time PCR detection of the OsHV-1 virus' DNA in the microVar (µVar) form in the mussel *Mytilus edulis* (at low levels). Although these results suggest that the virus may be present in mussels, the technique used does not enable the form in which the virus is found to be identified, *i.e.*, infectious particles or degraded viral genetic material. These observations require additional investigations on mussels' sensitivity to the OsHV virus and their role in the microbial ecosystem.
- recommendations (DGAl, DG Sanco) proposed on the analyses to be conducted to find the OsHV-1 virus in its µVar form during mortality episodes in the cupped oyster *Crassostrea gigas*. The objectives pursued were to minimise the risks of disseminating the viral infection when animals are transferred. The European Commission established a regulation in March 2010 to define the measures to be taken (containment with restriction on movement, etc.).

This expertise springs from studies made by the Repamo network and the LGP analysis unit since 2008. They are based on "sophisticated" analyses, i.e. which cannot today be considered as routine analyses, using transmission electron microscopy and sequencing. Pathology experiments (inducing mortality by contagion) were performed in order to explore the relation of causality between detection of infectious agents and mortality, thanks to the facilities at Ifremer sites in La Tremblade and Brest.

This activity led the NRL to issue 97 assay reports to the relevant health authorities (DGAL, DDPP, DDTM and ARS). This was three times the average number of reports in previous years, due to the number of TIAC sources resulting from the winter epidemic's duration and to the appearance of a new norovirus variant. In the period from 2008-2010, shellfish farming sites in the Thau lagoon (Hérault), Chenaux du Payré (Vendée), Etel river and Gâvres (Morbihan) were regularly affected by collective food poisoning.

The revised NF microbiology standards using impedancemetry were published in October 2010, on the basis of Ifremer studies. The European Union Reference Laboratory (Cefas, UK) brought this technique into European regulations. Using impedancemetry, results can be obtained in less than nine hours, compared to forty-eight hours with the ISO/TS reference method, and at a 50% lower cost. Ifremer had tested, validated and promoted this technique for ten years, and thus achieves recognition for its work from numerous French (nine in 2010) and foreign (three in 2010) laboratories, now equipped with it.

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Microtome used to section the flesh of molluscs for histopathology analyses

Mining code, more **expert** reports

The number of applications for marine aggregate exploitation and of offshore oil permits dropped in 2010 (ten, compared to eighteen in 2009). However, the scientific level and exhaustiveness of impact studies must comply with the increasingly strict requirements of public sector decision-makers (geology-sedimentology, physique, benthic biology, fisheries science), under the procedure for mining authorisations and the new rules of the Environmental authority. The expert assessments in question concerned aggregates (Côtes d'Armor, Seine Maritime, Gironde and Calvados), maerl, and hydrocarbons (Aquitaine, Bouches du Rhône, Finistère, and Saint-Pierre et Miquelon).

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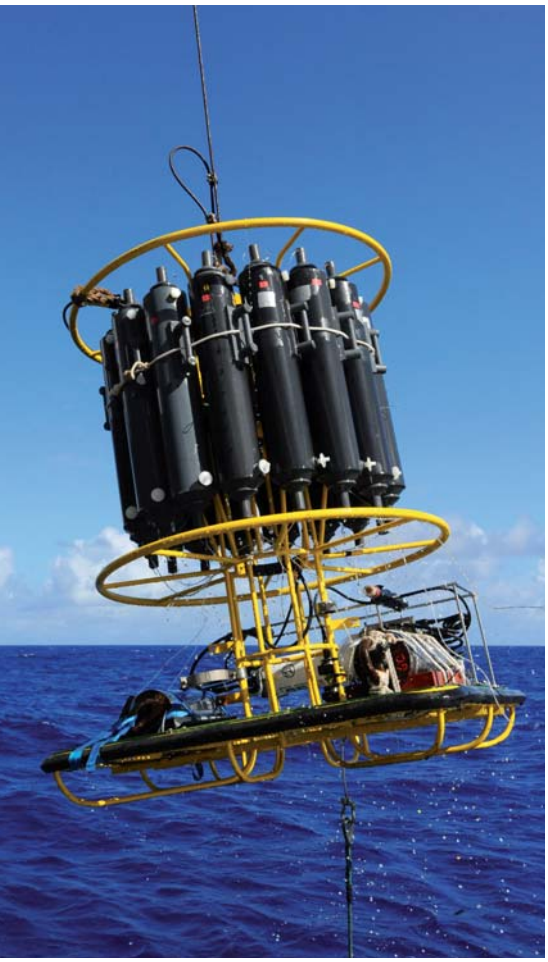
Bring up ROV Victor 6000

Power plants

In 2010, Ifremer drew up the evaluation of contamination by metallic discharges from the Areva site (La Hague), the hydrobiological summary of the Penly site commissioned by EDF in the frame of setting up an EPR nuclear reactor and the expert assessment of the impact of the tidal stream turbine demonstrator at Bréhat-Paimpol.

With the perspective of establishing an EPR nuclear reactor on the Penly site (in Seine-Maritime county), EDF asked Ifremer to summarise all the scientific observations made on the marine environment directly above the Pays de Caux region from 1975 to 2008. The outcome of thirty years of studies, with the acquisition of invaluable long-term time series, made it possible to specify the natural cycles in the region of physical, chemical or biological parameters and improve understanding of how they evolve or fluctuate.

The impacts on the marine environment of thermal and chlorinated discharges from the two nuclear units in service since 1986, appear to be undetectable with respect to the effects of particular meteorological episodes, of climate change on biogeographical trends in species, or of large-scale natural sedimentary movements which exist along this coast, from the Bay of Seine to the Pas-de-Calais (Dover Strait).



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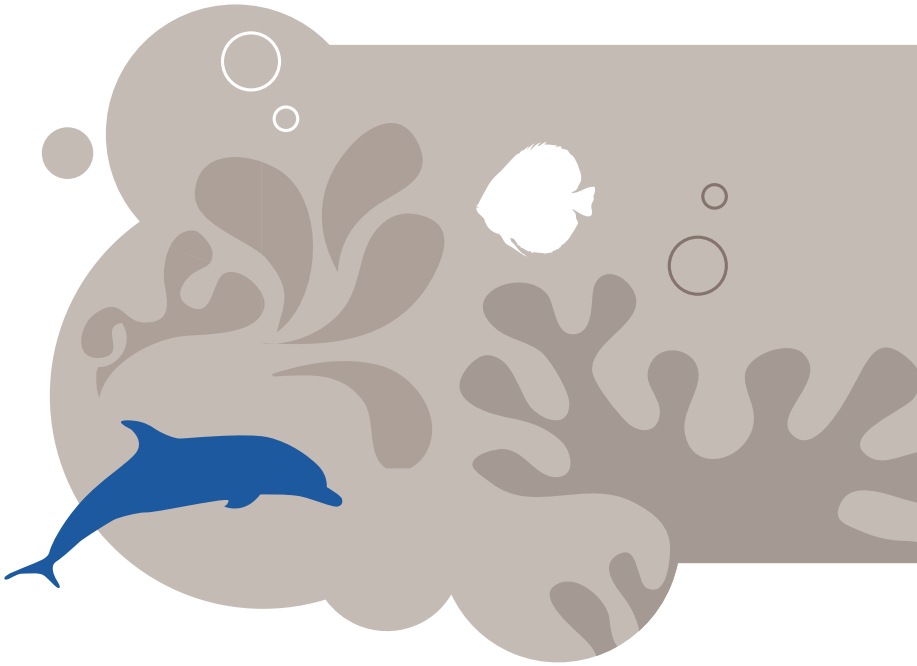
CTD Rosette



Impacts of uses and defining environmental health status **indicators**

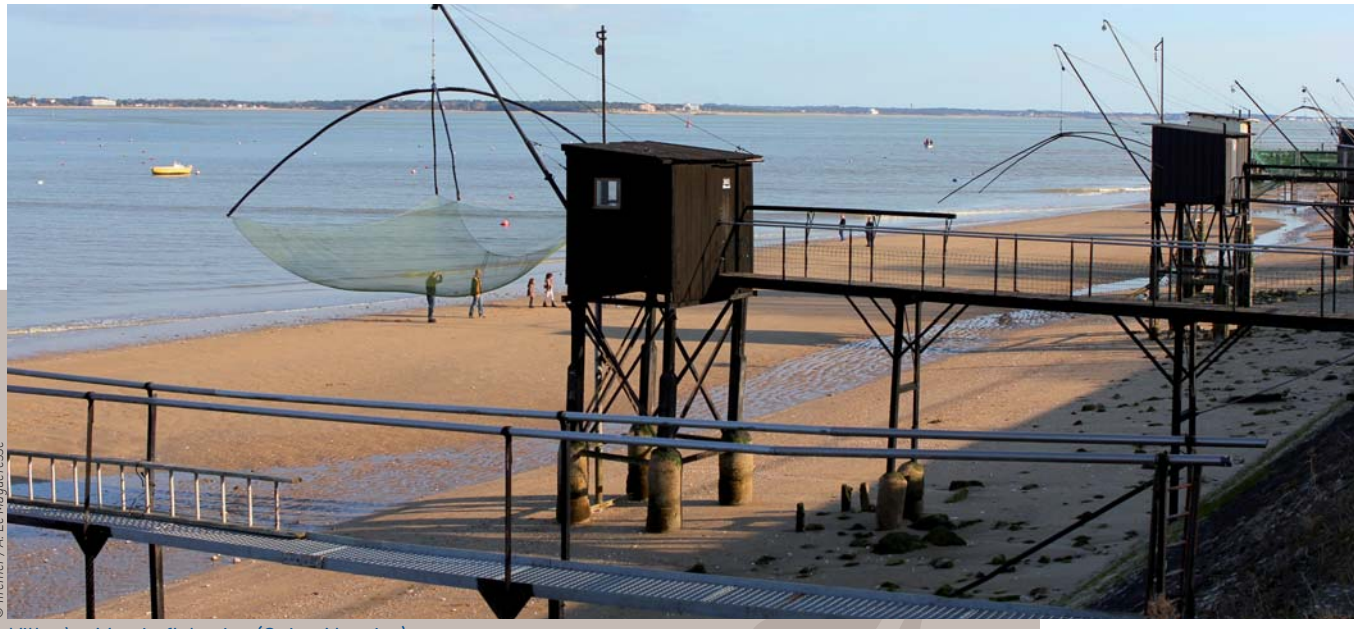
Ifremer was asked to provide its expertise on various themes: the consequences of the *Xynthia* storm on the Pertuis charentais coastal ecosystem at the Pointe de Penmarc'h headland; the impact of experimental mussel farms in the Auray river; studying new was to harvest native flat oysters in Mont Saint-Michel Bay; the impact of arsenic released from an industry in Aber Benoît; a health study on Fier d'Ars, etc.

Following the deadly storm *Xynthia* (night of 28 February to 1st March 2010), by mid-March, the microscopic marine flora observation array had detected a toxic bloom, whose onset was as sudden as it was wide-scale, of *Pseudo-Nitzschia* algae which are known for their ability to produce amnesic toxics. Consumption of bivalve molluscs (first mussels, then oysters, clams, etc.) from the Pertuis charentais region was banned. In early April, these toxins had contaminated scallops, as well as shellfish beds in Southern Brittany.

Decontamination of the bivalves was fast (about a month) with the sole exception of king scallops. They were contaminated at record levels of around half a gramme of domoic acid per kilogramme of mollusc flesh, whereas the threshold set by health regulations is 20 mg/kg. Their decontamination kinetics can last from one to several semesters. In December 2010, scallop fisheries were still banned from Southern Brittany to Pertuis charentais.

Several expert assessments were performed on behalf of MEDDTL in order to specify the phytoplankton, macrophytic (intertidal and subtidal) and benthic indicators which will enable the "good status" defined by European Directives of coastal water masses to be qualified. Indeed, there is much discussion between specialists from European countries about the advantages and disadvantages of various techniques (pigment data, composition of flora, ocean colour satellite images, flow cytometry, Mediterranean lagoon specificities, and so on). These techniques must be tested, compared and validated on zones which are "intact" or highly eutrophicated so that the best compromise can be proposed.

Indicators for benthic invertebrates and macroalgae in estuaries (called "transitional waters" in the Water Framework Directive) must be defined on the basis of a national consensus amongst experts from the scientific community by the end of 2011. The results will then be compared with those of other Member States. The same approach was implemented for methods to quantify opportunistic algae blooms, which will be intercalibrated on the European level.



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Ville-ès-Martin fisheries (Saint-Nazaire)

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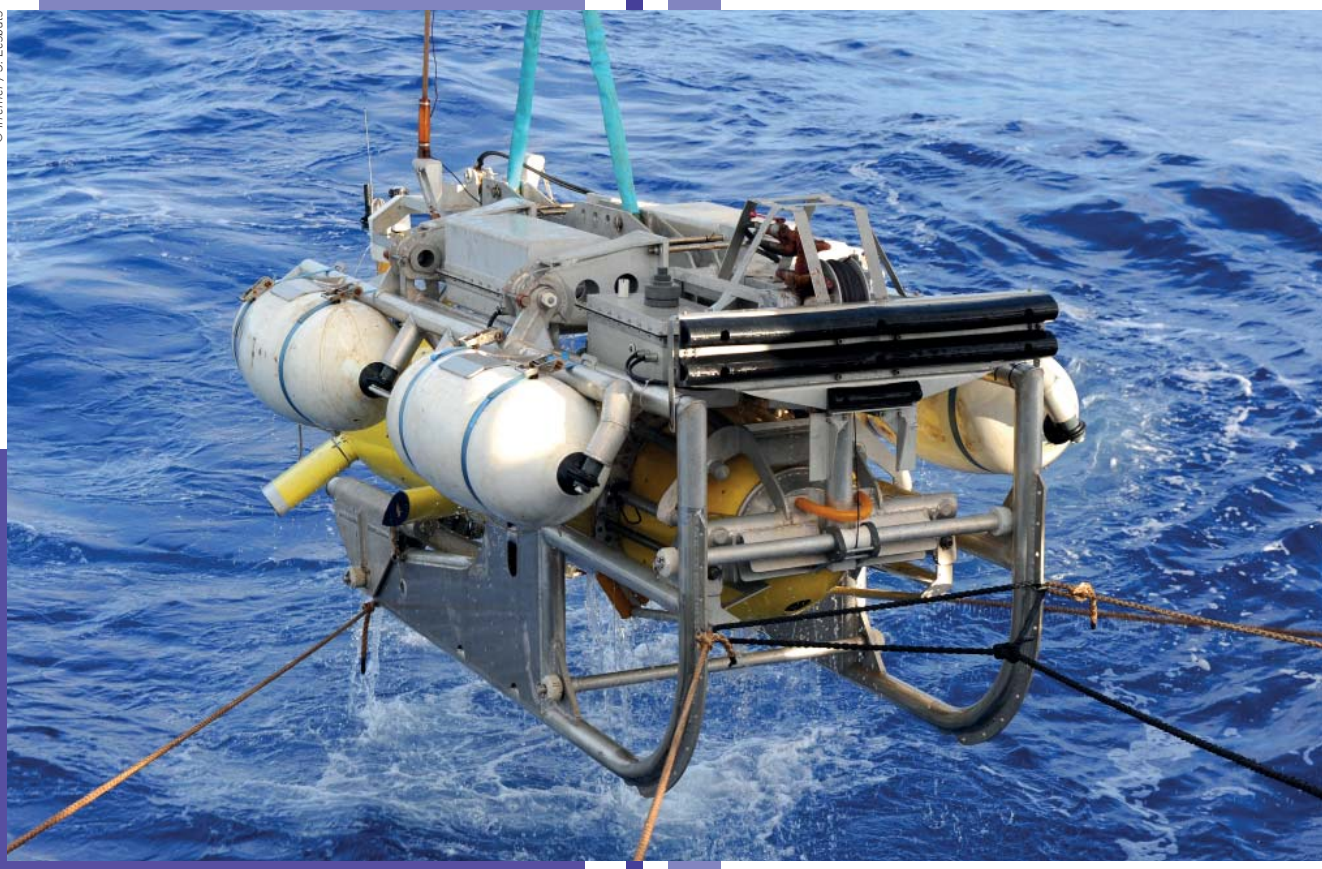

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Actions to support **research**

Large facilities serving ocean research

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Hauling in the trawl from the bridge of RV Thalassa

HARMONIE, IFREMER'S FISHERIES INFORMATION SYSTEM

The Harmonie system proposes an integrated approach to databasing of all data related to the fisheries sector in France. This includes data on uses (effort, production, regulations) and data characterising the resources (fisheries science cruises, biological sampling and acoustics, data on fisheries environments and economic data).

An **integrated** system

This approach is a true challenge in technological and organisational terms by the sheer volume, variety and diversity of sources of the data to be processed. It requires intervention by teams with a wide range of skills, i.e., fisheries scientists who define the objectives and processing, quality experts to harmonise procedures, IT specialists to develop software, operating teams who ensure the continuous smooth operation of the system and the checking of data quality and integrity on a day to day basis.

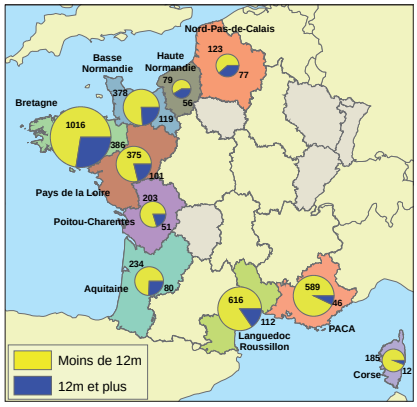
Harmonie is totally interfaced with the Fisheries and Aquaculture information system progressively being set up by the Ministry of agriculture and fisheries, and forms the "scientific analysis" component for data within this institutional system. There are regular exchanges between them, receiving data required by regulations (logbooks, vessel positioning, landings, etc.) and sending information observed or processed under Ifremer's leadership (observations at sea, results from surveys of fisheries professionals, and so on).

This integrated approach provides a true cross-analysis of the various data in order to confirm their complementarity, validate the quality and summarise the indicators which are the most representative of the national fisheries supply chain (Sacrois project).

Collecting information

The Allegro tool is an important component of the Harmonie system. It was developed to enable information collected by Ifremer, DPMA, its partners and service providers (surveys, observations aboard fishing vessels, biological sampling) to be keyed in. It delivers automated synchronisation between data entered by observers found all along the French coast, or even aboard professional vessels, and the Harmonie database. This synchronisation is a crucial factor for quality, because it gives users access to recent data on the vessels observed (references, activity, etc.).

Allegro has been operated since 2010: as of 12 January for the "observation at sea" strand, over 350 fishing trips had been entered, which represents over 3,600 fishing operations, 1,820 of which were thoroughly sampled for biological specimens.



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Distribution of French fishing vessels by region and LOA in 2009

The **mapping** aspect

Harmonie also proposes a cartographic dimension that gives a geographical view of Fisheries and Regulations (a "spatialised" fisheries information system, showing geographical distribution of stocks, distribution of the fishing effort, etc.). The component has several sections: atlas, expert system providing more concise or more detailed approaches depending on users' needs. It was developed in partnership (IRD, MNHN, AgroCampus Rennes, Sociétés Wemake and Terra Maris) with DPMA as contracting authority and Ifremer as project manager and was financed by EU funding.

The Fisheries and Regulations information system is also a source of summarised information about fisheries which is irreplaceable in numerous fields like spatial planning of fisheries uses, marine renewable energies, exploiting resources under the seabed and other sailing and maritime activities.

Interfacing of automated **observation** systems

And finally, Harmonie promotes the development of automated observation systems like Recopesca. Thanks to the active participation of professional stakeholders in the supply chain, a series of sensors suitable for use aboard fishing vessels perform regular observations of fishing effort and the physical environment of fisheries.

A supervision console was developed to keep track of sensor deployments. It can monitor the observations made and the quality and processing of data received, and detect and prevent any failures in the deployed equipment, all in real time.

Sismer's **Geosciences** database

For many years, Sismer has ensured the databasing of data from the instruments equipping research vessels operated by Genavir, i.e., echosounders, magnometers and gravimeters, seismics, CTD, etc.

Since 2010, the databasing now includes all data processed by submersibles, including video images. This progress was made possible by the upgrading of submersibles' equipment (going digital and back-up copies). This means that all fleet data is now both archived and accessible either via the Sismer website (www.ifremer.fr/sismer), or on request. This comprehensive databasing creates true value-added utilisation of our Institute's legacy of scientific data, its intangible heritage, so to speak.

In order to improve ship to shore data exchanges, as well as their overall quality, an Ifremer-Genavir working group was set up to draft a methodological guide and a quality assurance manuel.


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Multibeam echosounder data acquisition area aboard RV L'Atalante


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ROV Victor 6000 *on the deck of RV* Pourquoi pas ?

SeaDataNet, a pan-European facility to manage marine and oceanographic data

Ifremer is a stakeholder in setting up marine data networks with the following objectives:

- promoting exchanges of data, especially those from field observations, between scientific teams on national, European and international levels;
- proposing integrated information on national and European scales (e.g., Inspire Directive, MSFD) to be used as scientific support for environmental decisions;
- supplying the general public with harmonised access to environmental data in the framework of regulatory obligations (e.g., WFD, Nature and Environment Directive).

For five years, Ifremer was the leader of the SeaDataNet European research infrastructure project, linking over forty national marine data centres in thirty-five pan-European countries. By taking the technical standards (ISO, OGC, W3C) recommended by the Inspire Directive and applying them to the marine data field, this network gives users a single access point web portal) to over 800,000 observations in the water column, located in the different centres.

It also provided training and information to partners in the different EU and other European countries, thus promoting a harmonised and consensual approach to data dissemination policy, quality, processing and regional summaries for all seas contiguous to the European mainland.

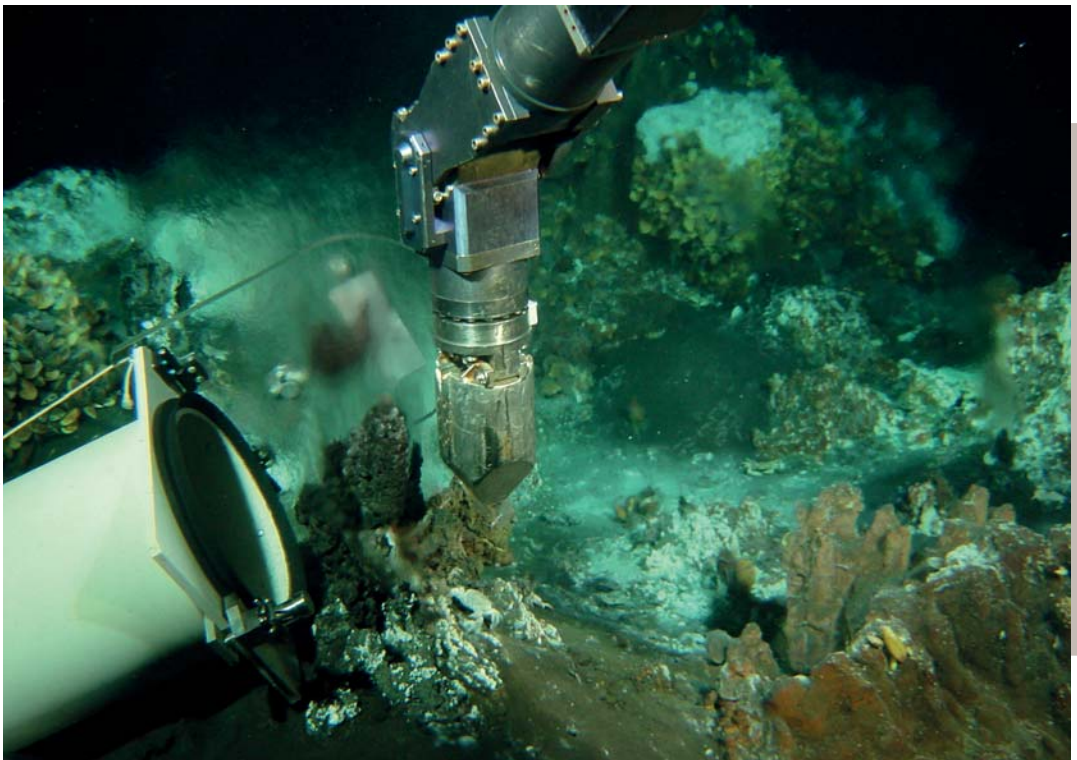
In 2010, SeaDataNet was co-organiser with the Intergovernmental Oceanographic Commission's IODE (International Oceanographic Data Exchange) programme of an international conference in Paris on marine data and information systems (IMDIS). The conference, attended by over 40% of participants from outside of Europe, confirmed the pertinence of choices made and contributed to developing system interoperability, particularly with countries in North America.

SeaDataNet is now the technical foundation for several marine data management projects on the European scale, on different themes (geology and geophysical data with Geo-Seas) or in different contexts (actions to prepare the setting up of a European observation and marine data network like Emodnet, DG-MARE).

These projects will make it possible not only to offer unified access services to users, but also to analyse any gaps in information (over time and space) and influence the setting up of observatories.

SeaDataNet's technical services are also replicated on the national level by several European states in order to set up their own institutional data networks to comply with EU Directives like the WFD and MSFD.

In situ *analysis inside an active smoker*



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Improving the **availability** of services

The efficacy of information systems can be judged by their capability to respond rapidly to requests, at the moment the user needs them. On-line access via a web portal or links page has become the preferred way of accessing scientific data.

That said, numerous studies such as those carried out under the aegis of DG-MARE in Europe consider that accessibility and availability of on-line services are points of difficulty. This is also an indicator measured in the framework of several national or European projects like MyOcean (Marine Core Services-GMES).

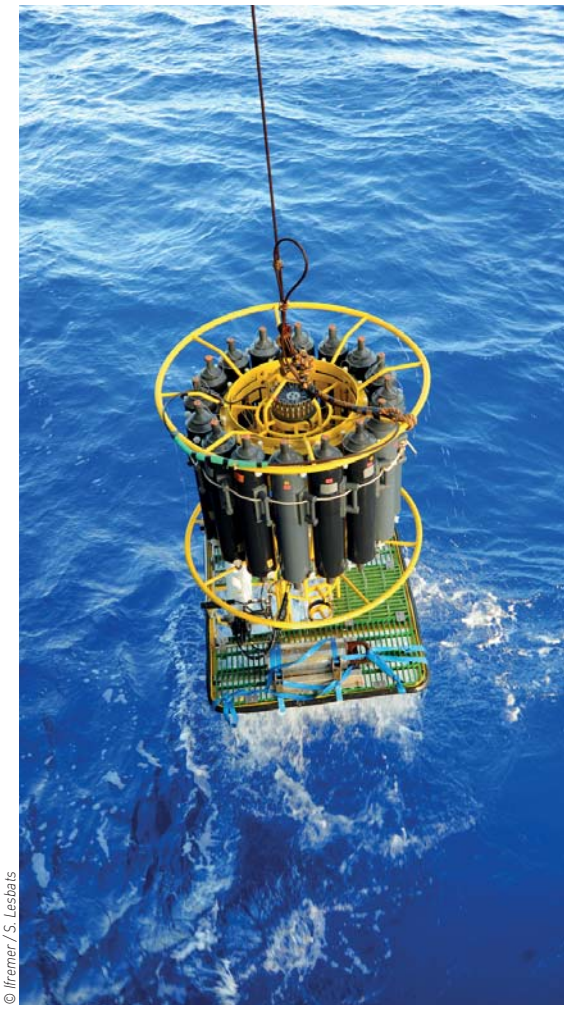
This availability brings a chain of skills and varied components into play, including the power supplies of IT servers, computing resource efficiency and the quality and relevance of data proposed to users. This skill and component chain is operated either directly by our Institute or by our partners and service providers. In order to improve the overall service rendered, a commitment policy (service contracts) has been implemented to better control the constraints, limitations and updating of the components which are links in the chain.

Deploying this service commitment policy comprises a strand for setting up technical tools and a strand for organisational aspects. Amongst the technical tools are:

- a new version of HelpDesk software to monitor user requests for assistance following a functional problem or difficulties encountered;
- a Configuration Management Data Base identifying all the components needed to ensure good service. This database makes it possible to share software, IT servers and the network components needed to keep applications up and running, to analyse impacts of changes made and to detect weak points.

Organisational improvements are part of the overall quality certification approach engaged by our Institute, more specially in developing aspects related to service commitments (ISO 20000 standard). Above and beyond certification, an effort to raise awareness and train the teams involved has been undertaken to improve the quality, as perceived, of the on-line services proposed. Identifying technical weak points led to modifying and considerably reinforcing the IT servers architecture:

- server virtualization so that applications can be compartmentalised on the same physical machine and thus avoid any side effects;
- commissioning of a new redundant cluster database server to ensure better availability, including during update operations;
- and significantly boosting the computing power of the CapArmor server (304 additional cores).



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CTD rosette brought back on board L'Atalante

The ocean fleet, a major research infrastructure

The French ocean research fleet (FOF) and the associated major facilities are a tool that is unique in Europe. It is vital for responding to the scientific community's needs in ocean exploration, as was highlighted during the Grenelle marine forum and summit meetings, to increase knowledge about marine biodiversity and about the Earth and its past, and to obtain long-term observations. To support national industrial policies, the fleet must also help to discover new marine resources (living, mineral and energy resources) and to possibly exploit them.

Since December 2008, the French ocean research fleet, managed by several organisations (IPEV, IRD, INSU, Cemagref and Ifremer) is part of the French roadmap for very large research infrastructures (TGIR).

Ifremer, as a resource agency, carries out a mission of high quality maintenance and management of a significant part of the deep sea and coastal fleet as well as the underwater vehicles and mobile equipment of TGIR FOF. Serving all the scientific disciplines of marine science, Ifremer's fleet also intervenes in public service missions (fisheries stocks assessments, marine environmental monitoring and surveillance in compliance with France's international commitments, etc.).

Two events were milestones in 2010, supplementing the traditionally diverse fleet programming activity, with the publication of the Fleet strategic and technical committee's (CSTF) first report (March 2010), which led to creating the UMS FOF joint service unit in late 2010, and the French blue water fleet's return to the Pacific Ocean for scientific cruises.

The bow of research vessel Pourquoi pas ?

© Ifremer / M. Gouilou

Unified **governance**

The CSTF's objective is to draw up recommendations for the Ministry of Research about the TGIR FOF's development. The committee brings together all management bodies identified in the French roadmap, ANR, qualified individuals and representatives from organisations which assess scientific cruises. Its initial conclusions focusing on the economic model, indicators, fleet renewal and overseas France were presented at the Fleet meetings in Marseille in March 2010.

The Ministry of Research appreciates the global vision of this so-called "very large infrastructure", and wanted unified governance to be established. In July 2010, the four fleet operators' first working group proposed that a joint service unit (UMS) to fulfil the fleet's multiple missions, without interfering with the specificities of the organisations.

A second working group drafted the text on the UMS joint service unit, whose objectives are to developing the integrated programming for vessels, major facilities and equipment and coordination of investments policies. The general organisation is made up of:
- the advisory and strategy setting body: CSTF,
- the operational structure: UMS board of directors,
- and the evaluation structure: two assessment committees.

These two committees (one for the deep sea, one for the coast) are in charge of assessing applications for ocean research cruises; access to ships is based on the excellence of the research project.

The new management structure of the French ocean research fleet came into being on the 1st January 2011. However, as of the summer 2010, the four founding members of UMS, under Ifremer's coordination, presented the first bid for an Équipex call for projects (conducted by ANR) in the frame of their joint investment policy. The project, which revolved around the interoperability of facilities, improvement of educational potential and successful European integration, was not selected.

© Ifremer / M. Gouillou

Monitor units in the cockpit for Victor 6000 *aboard RV* Pourquoi pas ?

Optimising fleet equipment and facilities

Through its four-year contract signed with the French State, Ifremer has undertaken to establish a medium-term plan (PMT) to renew the scientific facilities (including mobile facilities) and underwater systems. A systematic inventory of equipment was carried out in collaboration with Genavir in 2010 (operational status, degree of obsolescence and requests for developments made by the scientific community), leading to the evaluation of the cost of keeping it up to standard.

This PMT plan, covering a period of ten years, ranks the requirements for the next four years. To make it a useful tool for decision-making, the plan will be updated yearly.

Creating the UMS unit militates for extending the PMT principle to all the TGIR FOF fleet managers, so that the board of directors and the UMS's members have both balanced management and a global view of the fleet investment policy.

Back in the **Pacific**

The calling of the French blue water fleet is to be on all oceans. The national assessment bodies and relevant ministries issue regular reminders to that effect. But in recent years the programming for naval resources had not been sufficient for French flagged vessels to ply the Pacific Ocean. In 2010, six important cruises were carried out there in succession.

- Parisub (plume, ridge and submersible) for CNRS included twenty-four dives by *Nautile* to study the interactions of a ridge off Mexico (20 March to 16 April);
- Mescal (colonisation and adaptation strategies in extreme hydrothermal environments) for CNRS, observed the biological diversity of organisms associated with hydrothermal smokers (April-May);
- Ifremer's BIG cruise (31 May to 8 July) in the Gulf of California (Guaymas basin), a unique place which is well suited for a comparative study of hydrothermal sites and cold seep zones.

This mission highlighted the capability of the combination of the *Nautile* submersible (diving only by day) and the AUV (diving at night) to replace *Victor 6000* (remote operated vehicle which was unavailable).

- The Futuna-1 and 2 missions (August-September) on the French Exclusive Economic Zones of Futuna, thanks to dives with *Nautile* and AUV, delivered the means to produce the bathymetry map and acoustic imaging of the deep hydrothermal activity and to determine the presence of sulphide deposits.
- Wallis (25 September to 9 October), as part of the Extraplac legal continental shelf extension programme, supplied elements to characterise the "foot of the slope" from which a 60 nautical mile extension of the maritime zones under their jurisdiction could be claimed by the French authorities.

Deploying the Nautile *submersible from RV* L'Atalante

© Genavir / C. Lagathu

Nautile *leaving the hangar aboard* L'Atalante

© Ifremer / S. Lesbats

RV *L'Atalante* mobilised in the emergency situation off **Haiti**

As requested by the Ministry of Research, Ifremer modified the programmed schedule for its vessels at the start of 2010. The objective was to position RV *L'Atalante* as rapidly as possible off Haiti to carry out a French multidisciplinary cruise (Haiti-OBS, from 6 to 16 February) and to deploy seismological stations near the zone where the fault rupture occurred in the peninsula of Haiti on 12 January.

CNRS requested this cruise in order to record the numerous after-shocks which could occur in the near surroundings of the plate which had rupture and thus compensate for the lack of shore stations. The array at sea was complemented by installing a few stations in the Dominican Republic in order to locate the earthquake's after-shocks, characterise the segment where the break took place and assess variations in stress distribution. The OBS (Ocean Bottom Seismometers) were recovered in May 2010 by calling on local owners of fishing boats.

Partnership between the Ministries of Defence and Research

In the frame of agreements signed between the Ministry of Defence (French Navy) and Ifremer, a crossed partnership made it possible to build and operate two ships: RV *Beautemps-Beaupré* and RV *Pourquoi pas?*. This give Ifremer the right to ten days of access each year aboard the French Navy's vessel and Navy has the right to one hundred-fifty ship days aboard RV *Pourquoi pas?*. The joint scheduling with SHOM for the two vessels is done each year. This partnership has fulfilled its role and through it, three benthic cruises for SHOM and for the scientific community were promoted.

RV *Pourquoi pas?* conducted the ZMAG (SHOM) mission - the first coastal hydrography cruise, with operational deployment of SHOM's oceanographic survey boats for studies to update the sea charts and navigational documents for the French West Indies. The first operational use of the shallow water echosounder and the mooring of meteorological observation buoys were successfully completed.

The vessel then continued with the Bathysaintes cruise (31 January to 11 February) mission directed by the Earth physics institute in Paris IPGP in cooperation with SHOM, to map and characterise the active faults causing destructive earthquakes on the Antilles arc. Data from this cruise provided high resolution shallow water bathymetry for the Saintes plateau which is crucial for modelling the propagation of possible tsunami waves in the area. These bathymetric data, combined with sonar data for the plateau, will be used for the high resolution imaging of the active normal fault scarps responsible for the after-shocks from the 21 November 2004 quake on Saintes plateau.

Ifremer utilised its right to use RV *Beautemps-Beaupré* for Tanzaval. The objective of this short exploratory mission (University of Bordeaux I-CNRS) off Tanzania was to use acoustic surveying to collect the data needed to prepare a more extensive study mission. The zone offers exceptional perspectives to study the chronology of the East African rift's development and gain fundamental knowledge about the sedimentary systems in the deep sea environment.

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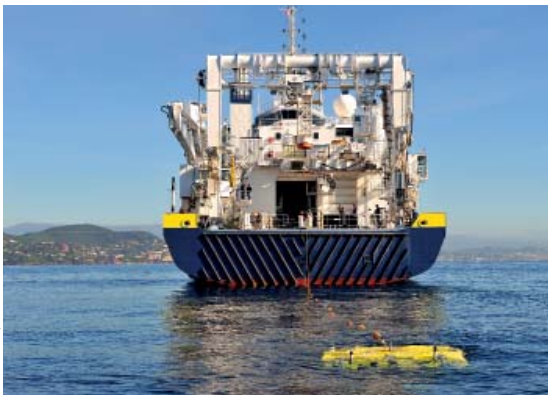
ROV Victor 6000



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ROV Victor 6000 *test cruise aboard RV* Pourquoi pas ?

A zone where the French fleet is often **present**

Over the past twenty-some years, French vessels have assiduously explored the Mid Atlantic Ridge to the south of the Azores and hydrothermal fields there with a range of features. Lucky Strike is one of the most extensive fields visited to date in the world ocean. In 2010, two of Ifremer's ships operated in this zone.

- RV *Suroît* deployed hydrophones in the Sofar channel of the Momar zone during the Hydrobs-Momar mission. The hydrophones will stay on the seabed to record noises in the sea for two years, in order to monitor the seismicity of the Momar area on a regional scale and the links between this seismicity and active hydrothermal processes on Momar sites.

- RV *Pourquoi pas?* carried out the Momarsatnet mission, jointly conducted by Ifremer and IPGP-CNRS to deploy an array of autonomous measurement instruments connected at the seabed and designed to continuously observe active hydrothermal processes of Lucky Strike. This was the first pilot experiment of its kind in a deep sea environment. The data acquired at this depth are transmitted to a surface buoy which sends them to research centres on shore by satellite.

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ROV Victor 6000 *after its major overhaul*

First major overhaul for ***Victor 6000***

The remote-operated vehicle *Victor 6000* went for its major overhaul at the end of 2009, after a ten-year cycle of activity. The overhaul lasted more than six months and was followed by a test cruise before resuming its scientific activity.

This first major maintenance operation consisted in replacing the obsolete hardware and software to start a new ten-year operational cycle, as well as perfecting the conditions for the system's deployment and improving IT maintenance methods.

A new record for the **Penfeld** thanks to a new synthetic cable

The Penfeld penetrometer was developed by Ifremer in 2004 to acquire data for marine sediment characterisation. Until now, the system's operability was limited in depth by the use of steel cables. In June 2010, a synthetic cable which weighs less in water was successfully tested aboard RV *Pourquoi pas?*. Five dives were made with Penfeld penetrometers, two of them reaching depths of 4,290 m and 4,525 m, with rod penetration to 30 metres. Previously the Penfeld had never exceeded depths of 2,200 m.

This cable will provide nominal operation of the Penfeld as deep as 6,000 metres. This performance opens up new perspectives for the scientific community using this unique tool.

Penfeld penetrometer in the test tank at Ifremer's centre in Brest

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Eurofleets project's second general assembly meeting

The Eurofleets project (towards an alliance of European research fleets) was launched in September 2009. It held its second general assembly meeting in Athens in September 2010 to make its first assessment, with the representative of the European Commission, the main source of funding (7.2 million euros out of a total budget of nearly 9 million euros) in attendance. Significant progress was achieved over the year and the rough outlines of a possible Eurofleets-2 are beginning to take shape.

In the framework of two calls for proposals launched in March 2010, numerous cruise proposals were received from all over Europe concerning five large vessels (including RV *Marion Dufresne* and RV *L'Atalante* for France) and thirteen smaller, regional class vessels. The cruises receiving the best assessment will be entirely covered by EU funding. Out of the forty responses received, thirty-eight complied with the defined criteria for eligibility. Two three-day sessions, reserved for twenty European students and post-doc fellows, were also organised in August aboard RV *Celtic Voyager* made available to Eurofleets by the Irish Marine Institute.

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Ocean research vessel L'Atalante

Ifremer is Vice-Chair of **OFEG**

The OFEG (Ocean Facilities Exchange Group) was created by the extension of the tripartite agreement (France, United Kingdom and Germany) of 1996, later joined by the Netherlands, Norway and Spain. The agreement enables members to barter "ship-time" or use of other major facilities.

During the twenty-third OFEG meeting (27-28 April 2010, Bergen) new governance was set up, with the Netherlands appointed as Chair, Ifremer was designated as Vice-Chair and our Institute also acts as secretary. At the end of the three-year term, the Vice-Chair generally takes over the Chairmanship.

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Partnerships

Promoting and sharing Ifremer's know-how

Promoting technologies at trade shows, negotiating contracts for service provision and cooperation with industrial firms, managing patent portfolios and pursuing collaborative research which contributes to creating economic value and development of our Institute's research and know-how. In addition, partnership agreements demonstrate the strong will for interaction between Ifremer and its industrial partners.

Participation in **trade shows**

In 2010, Ifremer was an exhibitor at five major international shows (oceanography, marine energy sources, the environment and the shipbuilding industry), to promote its products, services, equipment and know-how.

- the "Oceanology international" show (London): presenting oceanographic instrumentation and technologies, underwater vehicles, test facilities and large-scale projects (Esonet, Prévimer) ;

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Ifremer stand at the "Oceanology international" show

- "SeaTech Week" (Brest): conferences given and moderated by scientists and engineers from Ifremer and a range of technologies presented ;
- the international ICOE event (Bilbao): highlighting Ifremer's skills in MRE, existing facilities (test tanks) and facilities being created, such as the "France énergies marines" platform. In the frame of the European Prottec project, Ifremer shared its stand with the University of Plymouth ;


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Ifremer stand at the "ICOE" show

- the international Euronaval show (Paris): outlook for chartering ships and underwater vehicles, test facilities and seagoing facilities for work in very deep water ;
- the international Pollutec show (Lyon): coastal environmental expertise, tools and equipment (buoys with instruments, information systems, MRE platform) were presented.

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Ifremer stand at the "Euronaval" show

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Contracts for service provision and collaborative work with **industry**

Working closely with the legal affairs department, the business development department negotiated several agreements for consortia and cooperation, six of them signed in 2010.

Four large-scale chartering agreements were signed last year. For instance, RV *L'Atalante* was chartered for the Futuna 2010 cruise, financed by a novel public-private sector partnership associating Areva, Technip, Eramet, the MEEDDM ministry, the Marine protected areas Agency and BRGM.

Negotiations were concluded for seven provisions of test facilities, made available in sectors of activity ranging from biotechnologies to telecommunications. Moreover, other agreements involving consultancy, sale of software licences and data, sales of equipment, etc. reaped direct financial returns for our Institute.

In 2010, Ifremer's new Cinéma software (modelling and forecasts for sediment core samples) was filed and put on the market; licences for DynamiT software were sold with the related training course to the CSAR (Centre for Sustainable Aquatic Resources) and the German company Rofia Kloska GmbH.

Discovering, protecting and transferring **inventions**

Developing a development culture to enhance value and utilisations within Ifremer is one of the priorities set out in the four-year contract. In 2010, the first sessions to raise awareness about intellectual property were held for the scientific and technical teams on various Ifremer sites (New Caledonia, Brest, Toulon, Palavas and Sète). Emphasis was put on the need for scientific teams to inform the business development department at the earliest opportunity so that the best strategy can be determined to create technology transfers and value from research results, particularly through co-development with industrial firms.

The best practice guidebook on protecting intellectual property created by the business development department was presented and distributed to scientists during these sessions.

2010 was an outstanding year with an exceptional harvest of innovations. Ifremer recorded twelve claims of inventions, which led to the filing of eleven patent applications and two Soleau envelopes (these are not deeds of intellectual property, but do provide clear proof of the date of creation and clear identification of the creator). In addition, nineteen licensing contracts (for patents and know-how) were negotiated, including twelve which were signed in 2010. Six biological material transfer agreements (MTA) were established.

Examples of patent applications

- a process to concentrate and recover inert or living microparticles on a column and its installation. This patent was filed in joint ownership with INSA in Lyon
- expression of activity responsible for protein glycosylation in the microalgae *Phaeodactylum tricornutum*
- highlighting the increased activity of a novel archaeal protein as a reagent for molecular biology applications
- a subsurface float incorporating a system to help locate "black boxes"
- a device to recover a marine or underwater vehicle such as an AUV
- methodology enabling herpes virus to be diagnosed in oysters
- a device to analyse physical-chemical parameters for an instrument-bearing buoy

Project call for **"investments for the future"** and the European Prottec project

The business development department devoted major efforts to responding to the "investments for the future" calls for projects launched by the French State and helped to integrate a dimension of economic value development in projects sponsored by Ifremer. The department's expertise in these concepts so vital to project eligibility was greatly solicited in developing the three projects for facilities of excellence (Équipex project) and that of Laboratories of excellence (LabEx project).

The business development department also played a significant part in building the "France énergies marines" platform project which falls under the call for projects entitled "Institute of Excellence on Carbon-free energies" (IEED). It took part in various discussions with industrial partners to better comprehend their expectations, needs and strategy in MRE terms. The business development department, in relation with Ifremer's legal department, took part in drafting the "Business development strategy/ Intellectual property models/Relations with competitiveness clusters" document.

Above and beyond its own business development and technology transfer activities, our Institute is working alongside UBO-Bretagne Valorisation, the Universities of Plymouth and Exeter and Marine South East in the European Prottec project. This project was launched in March 2009, with the objective of improving the innovation chain by promoting technology transfers from public-sector research to industrial firms. In keeping with this spirit, Ifremer organised a seminar where partners could talk about the theme of marine renewable energies and common issues could be highlighted. This should lead to setting future collaborative work between academic research and industrial firms in the sector.

Exchanges between scientists from Ifremer, Plymouth and Exeter made it possible to share knowledge, identify converging research orientations and discover the project partners' facilities.

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Regional partnerships

Ifremer activities in French regions match the issues specific to each territory with our Institute's national orientations of economic development, protecting ecosystems and managing coastal risks and hazards. This results in the deployment of facilities and technological resources, research programmes, expert assessment and monitoring missions, which are all supported and co-financed by public sector authorities, in keeping with the priorities of Ifremer's four year contract.

To do so, Ifremer has both established and strengthened a large number of national and local partnerships with research bodies, PRES clusters and universities (thanks to the university reform bill), with a view to developing specialised, high-performance research clusters with a strong global reputation.

Ifremer is thus participating in various scientific interest groupings (Cochise, Europôle Mer, Caromed, and so on). On the regional level, moves have been made to bring together teams and expertise, and make joint use of tools, in research fields such as fisheries science or biodiversity. One of the 2010 milestones was the creation of a microalgae studies cluster with the National Museum of natural history. Our institute is also working side by side with water board agencies and the agency for marine protected areas in implementing national programmes for the application of European directives.

In terms of the local economy, Ifremer is one of the main partners of world-class competitiveness clusters like the Brittany and PACA marine clusters. Numerous certified projects related to our research themes (marine technologies, biotechnologies, biofuels, safety, sustainable development, etc.) are co-funded by Ifremer and conducted in cooperation with industrial firms and players in regional economies.

Being directly involved in the economic activity of French regions, through its research, resource assessment surveys and action in monitoring coastal areas, working through its regional teams, Ifremer maintains close links with professionals and the marine and maritime supply chains.

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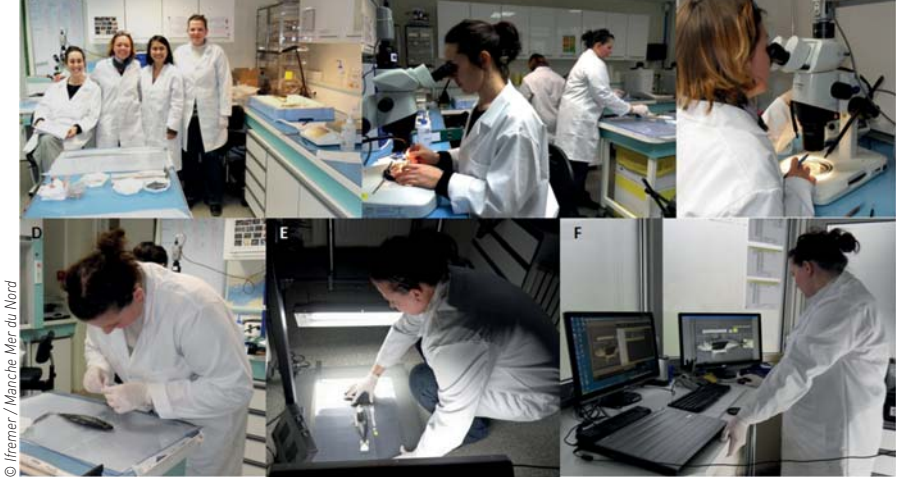
CHANNEL-NORTH SEA SEAFRONT

For coordinated management of **protected areas**

The marine protected areas agency has set up a mission to study the creation of a marine nature park located at the mouth of three estuaries in Picardy (rivers Somme, Authie and Canche). The working group on shared knowledge, led by the Ifremer Channel-North Sea centre, brought together the entire scientific community (universities and public-sector institutions), associations and NGOs and the professionals concerned. The studies led to defining the possible boundaries for the nature park and proposing orientations to promote knowledge, protect marine heritage and promote the sustainable development of fisheries and uses.



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Food webs laboratory team in action

Studying species **dynamics**

2010 was the first year that the age-reading or sclerochronology cluster in Ifremer's Channel-North Sea centre was in operation. Its state-of-the-art equipment to process and analyse images of skeletal parts (otoliths, scales) was financed thanks to significant funding from the Nord Pas-de-Calais CPER station-region plan contract. Another highlight of the year was the transfer to this cluster in Boulogne of species previously processed in other laboratories. This means that over 30,000 calcified specimens were processed in 2010.

On the European level, the cluster took part in three workshops devoted to fish growth and is engaged in several research projects involving the monitoring or new species (Nespman project), study of hake and flat fish nurseries (Merlumed, Colmatage projects) and setting up reference image repositories (WebGR project).

The cluster was awarded the Ifremer 2010 trophy for Scientific, technical or technological innovation for its software to digitally process calcified structures (TNPC).

Ifremer
POLE DE SCLERO CHRONO LOGIE

Food web analysis laboratory

A team specialising in studying the structure and functioning of marine food webs was set up thanks to the Channel programme within the Fisheries research laboratory in Boulogne-sur-Mer. This field of research addresses the interactions in the food web, from marine living resources to secondary and higher consumers. A food-web analysis lab was entirely equipped in order to develop a thorough empirical approach within various national and international projects. The studies conducted (species diet, food-web structure and predator-prey relationships) participate in developing an ecosystem-based approach to marine living resources in accordance with the European Common Fisheries Policy.

Channel programme: federating marine living resource research under a joint label

The Channel site studies programme was officially launched in March 2010 at a conference in Rouen which brought together over ninety participants, politicians, managers and users of the English Channel area. The Channel programme aims to gather the scientific studies being developed in this maritime area and as of today includes nine research projects for an overall budget of about 30 million euros and over fifty partner organisations.

Many themes are being studied (ecosystem approach, governance, impact of human activities, ecosystem trends) enabling an integrated approach to the marine environment which can give managers and decision-makers the tools they need to maintain sustainable exploitation of resources in the English Channel (http://wwz.ifremer.fr/defimanche).


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Participants at the conference for the Manche chantier (on English Channel)

Comanche, for the sustainable management of scallop stocks in the English Channel

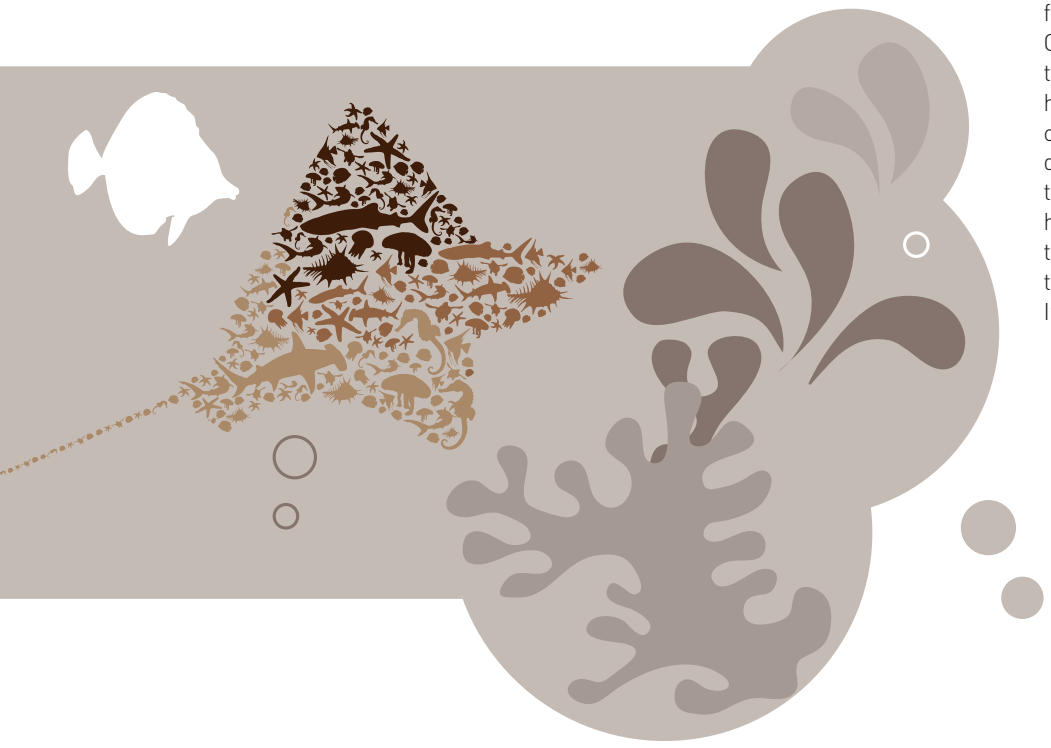
The Comanche project (Ecosystem interactions and anthropogenic impacts on Atlantic King scallops in the Channel) is financed by the ANR in the frame of its Systerra 2010 programme. It aims to improve our knowledge about the scallop *Pecten maximus* on the scale of the English Channel, calling upon a large range of scientific disciplines (physics, chemistry, genetics, ecology, geostatistics, modelling, etc.). The project is scheduled to begin in early 2011 for a three-year period. It will enable progress to be made in an ecosystem-based approach to fisheries and will propose new decision-making tools for sustainable resource management on an operational basis.

Assessment of **scallop** stocks in the Bay of Seine

Each year, in partnership with local authorities and professional organisations, Ifremer conducts a survey to assess king scallop stock abundance in the Bay of Seine. For the fortieth Comor cruise, the station's partners were invited aboard RV *Thalia* for presentation of the cruise and its objectives.

© Ifremer / S. Lesbats

Assessing scallops stocks during the Comor cruise aboard RV Thalia



Sustainable development and teaching in Lower Normandy

The regional Institute for sustainable development in Lower Normandy (IRD2) was created on the initiative of the regional council and the University of Caen Basse-Normandie, in partnership with the Ifremer station in Port-en-Bessin. IRD2 federates various stakeholders in the area and enhances the value of regional potential in terms of sustainable development by promoting partnerships between the territories, research and higher education.

Ifremer performed expert assessment missions for the Ceser in Lower Normandy, writing two study reports respectively dealing with "Marine renewable energy sources (MRE), potential and perspectives in Lower Normandy" and on "Research, innovation and higher education related to the sea and shore in Lower Normandy". A publication entitled *Poissons, habitats et ressources halieutiques: cas de l'estuaire de la Seine*, coordinated by Jocelyne Morin, senior researcher in the Port-en-Bessin fisheries resource laboratory, focuses on ten years of research. It was published by the Seine-Aval PIG in its collection called "Fascicules".

Ifremer also facilitated a series of conferences at the Maritime high school in Cherbourg to present the main scientific aspects of fisheries management: how TAC and quotas are determined, observation of the sea, etc. to the students there. In 2011, these interventions will be extended to three maritime high schools on the seafront, following the signing of an agreement between the DIRM East Channel-North Sea and Ifremer.

Developing the logistics **platform** in Brest

The government's recovery plan made it possible to finance (for 2 million euros) the development of the logistics platform for research cruise preparations at the Ifremer centre in Brittany. The minister of the Recovery plan, Patrick Devedjian, visited the facilities when he came to Brest in April 2010.

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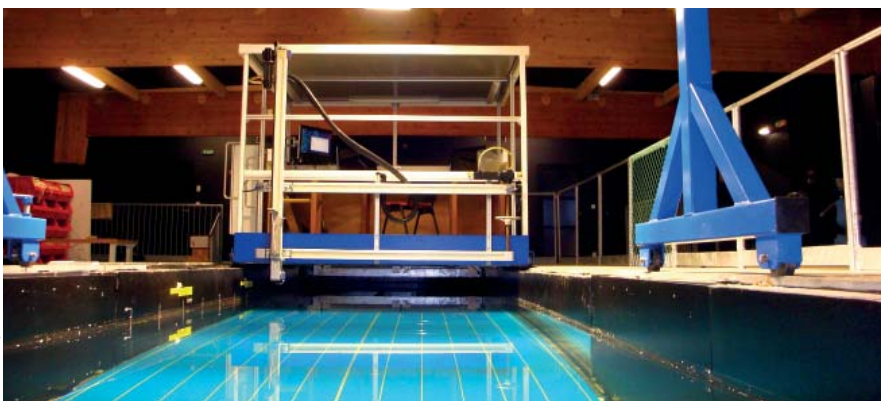
Genavir's workshops and storage platform at Ifremer's Brittany centre

A storage platform with a surface area of 1,500 m² and a workshop with the appropriate equipment to lift and handle containers and shipboard lab units were created. These facilities will be supplemented by offices to accommodate all the Genavir operator's technical staff members.

The modernisation of the warehouse, financed by the Brittany regional council to the amount of 600,000 euros, was completed in 2010. Bringing the facilities into compliance with standards creates a break in the flow of departing-arriving vessels. Access to the premises is now controlled by badges, making it possible to take steps for "accreditation as known consignor" which makes going through Customs easier when exporting.

Upgrading of Lorient **test tank**

The trawl testing tank in Lorient, built in 1976 and operated by Ifremer was given a complete overhaul, in compliance with the new requirements expressed by fisheries professionals. This renovation is the outcome of mobilisation by those working in fisheries and the public authorities in Brittany. The project was financed by the Pays de Lorient combined district council, the Morbihan general (county) and the Brittany regional council's fisheries and research services, for a total cost of 1.08 million euros. The resources implemented will serve the new fisheries guidelines: selectivity, reducing the impact on seabeds and energy savings for fishing gear. The tank is also used for certification of equipment, marine renewable energies and maritime and general professional training in relation with the CCSTI and the University of southern Brittany (UBS).



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Test tank at Ifremer station in Lorient

Climate data processing

The SMOS (Soil Moisture and Ocean Salinity) satellite observes two key components of the water cycle: sea surface salinity and soil moisture on land. Raw payload data are processed in the ESA centre in Spain and then sent to the SMOS (CATDS) level 4 data processing centre at the Ifremer centre in Brittany.

To perform the reprocessing of the CATDS data, the computing power of the Caparmor scientific supercomputer was boosted by 20% by adding 304 high performance processing cores to the existing 2,048 cores. The CATDS was developed by CNES in close cooperation with Ifremer, and was inaugurated on 15 October 2010.

Creation of a toxic **microalgae** cluster

In creating the Centre for coastal system research and education (Cresco), inaugurated in Dinard in 2009, Ifremer and the National museum of natural history (MNHN) reasserted their will to bring their programmes and locations in Brittany closer. In Concarneau, regrouping the teams on the MNHN site confirms the creation of a cluster for the identification of toxic microalgae, a particularly sensitive theme in Brittany.

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Cresco laboratory

Pooling means, resources and expertise

With the perspective of create a broad-ranging network of marine protected areas, Ifremer and the Agency for marine protected areas have developed cooperation in their respective fields of expertise. In the frame of the "French seas performance indicators" project begun in 2009, the Ifremer centre in Brittany has hosted several researchers from the AAMP in order to adopt similar working methods, share skills and jointly use IT systems.

Brittany Marine Cluster **partnership**

Ifremer takes part in the governance and examination of projects of the world-class Brittany marine competitiveness cluster which is closely coordinated with the Provence-Alpes Côte-d'azur (PACA) marine cluster. As the main research stakeholder in the marine cluster, our Brittany centre is involved in over half of the projects with the cluster's seal of approval, particularly on themes like "biotechnologies", "environment and coastal planning" and "marine renewable energy resources". Ifremer is a partner in forty-seven of these projects, eight of which were completed in 2010.

Projects with the Brittany Marine Cluster label

The NOSS project (reliable and competitive salinity sensors for coastal water studies), led by the NKE firm, led to the development, in partnership with Ifremer, of a range of ocean profiling floats which can automatically measure ocean temperature and salinity over 2,000 metres and for a period of three years.
Prévicot (tailored coastal forecasts for all users of the sea), led by the Actimar firm, is a project aiming to develop special ocean analysis and forecast products in the coastal zone using the Prévimer database developed by Ifremer (applications for shipping, shellfish farming, dispersal of coastal pollution, etc.).

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Arvor and Provor profiling floats manufactured by the NKE firm

Girac (delivering consistent bathing water quality), led by Véolia and developed in cooperation with the PACA marine cluster, provides optimised real-time management of water treatment plants. Complex modelling based on four test cities (Brest, Saint-Malo, Toulon and Antibes) has resulted in a simple to use system for water system managers. This is a promising project for applications worldwide.Marquopoleau (detecting the source of coastal water pollution) piloted by the Littoralis company grouping, associates ten partners (scientific teams, private-sector analytical laboratories, Water board, local authorities and DDASS county-level directorates for health and social matters). It commercialises tools to measure and diagnose water pollution which can be used by all water analytical laboratories, whether in the public or private sector.

Europôle Mer

Directly in line with the priorities set out in our strategic plan, Ifremer is one of the main scientific partners in the Europôle Mer scientific interest group, alongside the University of western Brittany (UBO), Pierre et Marie Curie university (UPMC) and the CNRS. Researchers and engineers from the Brittany centre co-moderate each of the SIG's five research orientations. Ifremer, in association with the PRES cluster of the European university of Brittany (UEB) and UBO contributes to an international chair on deep sea floor exploration and knowledge.

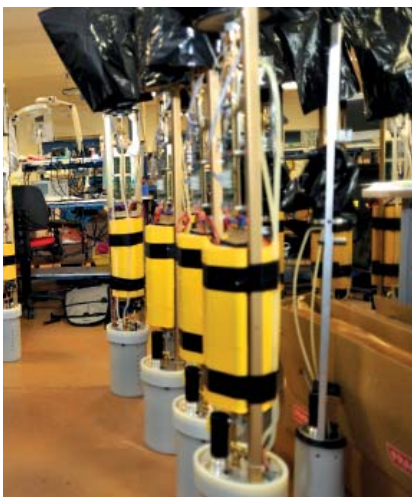
State-region plan contracts

The two Crest Argo and Prévimer projects benefit from co-funding provided in the frame of the CPER state-Brittany region contract, complemented by ERDF.

Argo is a global project for *in situ* ocean observation, conducted in the frame of the world climate research programme. The purpose of the Argo regional scientific and technical expertise centre (Crest Argo) is to organise expertise related to the project. It is structured around the Coriolis data centre in partnership with Ifremer, IUEM, SHOM, IRD and the Brittany regional council. In 2010, the data validation system (ISAS) was put into operational use, significant progress was made in understanding the processes of water mixing and important progress was made in developing oxygen sensors to equip the floats commercialised by the NKE company.

Prévimer, in its pre-operational phase, is a forecasting and observation system for coastal seas. It collects data and produces short-term forecasts on currents, temperature and salinity, waves, surges and phytoplankton production. The project is conducted by Ifremer and SHOM, and financed by the Finistère general council and Brest-Métropole Océane. It is intended for anyone who uses the sea, and in 2010 both the number and type of users increased: the general public, professionals, public authorities, consultancies, scientists, etc. The deadly storm Xynthia proved the interest of this sort of observation system.

NKE Arvor and Provor profiling floats



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Contribution to "investments for the future" project

The Brittany centre participated directly in drawing up projects in the investments for the future framework, now called "Initiatives for excellence".

- Ifremer's Brittany centre led an Institute of excellence project for carbon free energy sources (IEED), in partnership with some fifty stakeholders, including the Brittany marine cluster, the Brittany regional council and industrial firms.
- Teams from the centre took part in drawing up four projects for facilities of excellence (Équipex) of national scope, involving marine observatories (Argo for global ocean observation *in situ*, EMSO for sea floor observatories), and their equipment (intensive computation cluster for the sea, mesocosm network).
- The laboratory of excellence project, sponsored by UBO-IUEM, received a significant contribution from Ifremer's labs in association with UBO, CNRS and IRD within three UMR joint research units whose excellence was acknowledged by Aeres.
- The centre's team made a major contribution to developing the Initiative for excellence interregional Brittany-Loire Region project (Campus d'innovation Ouest, IC Ouest).

Developing marine **renewable** energy sources

One 2010 milestone was the scaling up of marine renewable energies (EMR), with studies to prefigure the MRE platform announced at Cimer in December 2009. In this framework, the Brittany centre received the visit of Maria Damanaki, European Commissioner for Maritime affairs and Fisheries in May 2010. Ifremer took advantage of the occasion to present its current state of reflection to the most important personalities in Brittany. The industrial stakeholders of the Brittany marine cluster reported on their projects, thus illustrating the necessary collaboration between the public sector and private sector in order to successfully develop this industrial supply chain both nationwide and to be exported.

Monitoring of coastal seabed flora and fauna

The benthic monitoring network, Rebent Bretagne, was created by Ifremer after the sinking of the *Erika*, in cooperation with several scientific partners. Since 2007, it has received funding from the Brittany regional council and from ERDF in the frame of the CPER state-region plan contract. The Rebent Bretagne meetings brought one hundred seventy people to Brest, showing the network's vitality, methodological and technical advances, its enhancement of scientific value and its interest for the implementation of European directives (MSFD, WFD and Natura 2000).

WISE seminar, measuring and **modelling** waves

The international WISE conference is organised by Ifremer and attracts the world specialists in wave measurement and modelling to Brest. Its seventeenth event was attended by a record number of participants indicating a broader scientific community (oceanographers, specialists in fundamental physics or coastal civil engineering). French contributions particularly focused on remote sensing, a field of specialisation in Brest.

© Ifremer / J. Prou

Oyster farms on the Ronce-les-Bains bank (Charente Maritime)

ATLANTIC SEAFRONT

Marine **ecotoxycology**: a new research facility

The scientific interest group Cochise (chemical contamination monitoring and marine ecotoxicology) was created to cope with societal challenges and regulatory requirements (Reach, WFD, MSFD). By regrouping the existing forces, Cochise aims to develop research in the field of chemical contamination on the Atlantic seafront. The group brings together teams from laboratories at Ifremer Nantes and the University of Bordeaux. It increases marine ecotoxicology research capacities and encourages the sharing of analytical tools and technical platforms. The SIG provides a single portal to promote interactions with industry and develop expertise on the scale of the Grand Sud Ouest cluster.

Quality assurance and accreditation

The Genetics and pathologies laboratory (LGP) undertook a quality management approach in 2002 for histopathological analyses. This led to its accreditation in October 2009, following an initial Cofrac audit. The second audit conducted in 2010 renewed the laboratory's accreditation. This accreditation is essential for carrying out the National reference laboratory (NRL) assignments for marine mollusc diseases entrusted to LGP on 29 December 2009.

© Ifremer / J. Prou

Preparing oysters for genetics and pathology studies at Ifremer's station in La Tremblade (Charente Maritime)

An **interactive** Atlas of coastal monitoring networks

Since 2006, Ifremer and the water agencies have been working together to implement coastal monitoring networks which meet Water Framework Directive (WFD) requirements. In the Loire-Bretagne and Adour-Garonne river basin districts, results from WFD monitoring were used to create an interactive atlas: mapping summaries, supplemented by detailed data sheets, making it possible to visualise the boundaries and types as well as the quality of water bodies and various monitoring networks. The atlas also provides access to the sampling protocols and the way coastal and transitional (estuarine) water quality indicators are calculated. The atlases and information about the two catchments can be accessed from the web page http://envlit.ifremer.fr/surveillance/directive-cadre_sur_l_eau_dce.

Management of **resources** and risks in coastal areas

The Gerrico (global management of marine resources and of risks in coastal areas) project received funding from the Loire Region over a three-year period. It was mainly carried out on the bay of Bourgneuf site, involving scientists from Ifremer and the University of Nantes who are either senior or junior researchers in training (including three PhD theses). The studies are organised according to three theme-based orientations: creating value from marine resources and bioproduction; risk analysis and management applied in particular to oyster farming; and modelling interactions between nature and society. Participation by multidisciplinary teams (biologists, physicists, geographers, economists, etc.) at various stages in the modelling chain contributes to developing a shared vision and culture on issues related to shellfish farming resources.

© Christiane Blanchard / Gerrico

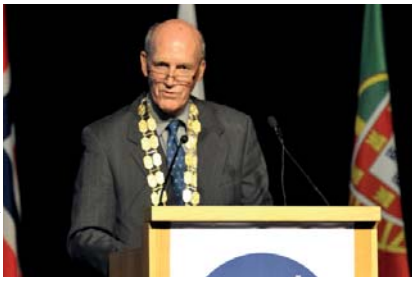
Oyster bags, Fromentine (Vendée)

The Écoval network

The green theme on the environment has become omnipresent in ads and communication about products. Assessing the impacts of consumer food products has become a major stake both in terms of guiding public policies and of industrial strategies. The Écoval (eco-design and value development) joint technological network was created in 2008. It is an interface to meet the stakes of public policies and the needs of the agrifood industry, by developing a synergy between research, development, technology transfer and educational institutions. The network conducts studies on themes of eco-compatibility of products and processes, as well as recovering energy and utilisation of matter.

Eco-compatibility of seafood products

The seafood production and processing supply chain is now represented by Ifremer's recent joining of the Écoval joint research network. Our Institute has a special position, alongside Ademe and Afnor, for studying environmental impacts of supply chains and processes implemented in producing and processing marine products and seafood.



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Mr. Mike Sinclair, ICES President

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Mr. Jean-Yves Perrot, CEO of Ifremer

ICES 2010 conference

In collaboration with Ifremer, the International Council for Exploration of the Sea (ICES) organised its annual scientific conference at the Conference centre in Nantes. Nearly eight hundred delegates from thirty-six countries presented their papers on topics like integrated coastal zone management, contaminants, benthic indicators, aquaculture, bio-invasions, toxic algae blooms, biodiversity and so forth. The outcomes of the Census of Marine Life programme, which Ifremer research scientists take part in, were presented on the occasion. ICES currently has twenty member countries along the North Atlantic and Baltic seafronts, and in addition, six countries with affiliated membership status. NGOs are accepted as observers in the various bodies.

© Ifremer / É. Buffier

View of Toulon bay from Mont Faron

MEDITERRANEAN SEAFRONT

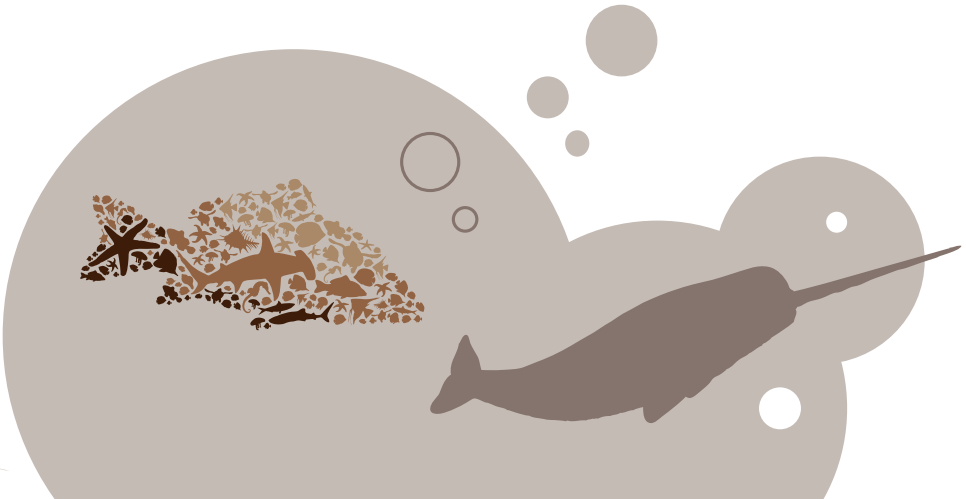
Observing and monitoring **lagoons**

The Languedoc-Roussillon regional council continued to finance research and monitoring programmes for Mediterranean lagoons undertaken by Ifremer's Mediterranean centre. They were:

- the 2010 action programme of the 2007-2013 lagoon monitoring network and the Adecom 2009-2011 research programme aiming to reduce cupped oyster mortality in the Mediterranean, in partnership with the Hérault general council and the regional shellfish farming section;
- a study on the spatial-temporal dynamics of phytoplankton communities in Mediterranean lagoons and on developing quality descriptors for water bodies and benthic ecosystems;
- a thesis on the hydrosedimentary functioning of a lagoon ecosystem (complex of lagoons Palavas/étang de l'Or/Rhône canal at Sète).

© Ifremer / H. Farrugio

Aerial view of Thau lagoon and the city of Sète



Water **protection** and management

Under the Water Framework Directive (WFD), monitoring surveys were conducted on the scale of the French Mediterranean seafront, with financial assistance from the Rhone Mediterranean water agency. Chemical data obtained from passive sampling devices were published for the first time in the 2010 report, thus sanctioning the technique's transition to operational status.

© Ifremer / J.L. Gonzalez

Deploying passive samplers to measure chemical contamination

Ifremer and the Rhone Mediterranean Corsica water agency (AERMC) organised a symposium on coastal environmental management in Marseille, on the occasion of the fifteenth anniversary of our cooperation. This meeting gave guidance for the future orientations of our collaborative work.

Ifremer's Corsica centre worked with Cemagref to perfect a "fish" indicator in order to determine the quality of Mediterranean lagoons. The study followed several data acquisition phases, from qualifying the relationship between the fish and its environment to developing a statistically robust indicator. An intercalibration exercise brought European research scientists (from Greece, Italy, Spain and France) together on the Diana and Urbino lagoons in Upper Corsica, where they compared different sampling techniques and checked the reliability of the indicators.

Sustainable management of fisheries

Ifremer proceeded with stock assessments of small pelagic (anchovies, sardines, etc.), demersal (hake) and benthic (red mullet, angler, etc.) fish. Our Institute also implemented a new abundance assessment survey of blue fin tuna using flyovers of the Gulf of Lion to detect schools at the surface.

© Ifremer / O. Dugornay

Hake, a demersal species studied by Ifremer

Making fisheries summary reports helped in drawing up fisheries management plans. By analysing the latest fisheries data acquired, combined with all the available knowledge and expertise, Ifremer formulated diagnoses and proposed scenarios for sustainable fisheries management. These results were incorporated in the coastal fisheries métiers management plans, in the framework of applying the European Commission's regulations for fisheries in the Mediterranean.

Ifremer's Mediterranean centre pursued its partnership with the Mediterranean association of producer organisations (AMOP) which began in 2009, for fisheries assessment in the framework of French blue contracts (Barnier plan). Sampling of anchovies and sardines in the gulf of Lion was performed following a scientific protocol. The data acquired will enable detailed monitoring of these populations, to supplement the scientific cruises which have been conducted on these species for more than fifteen years.

State-region project contracts

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Volumetrics of CETSM European subsea technologies centre in La Seyne-sur-Mer

The project for the CETSM European underwater technologies centre at La Seyne-sur-Mer which was undertaken in 2009 continued in 2010, with construction work beginning on the building and the purchasing of equipment and facilities to be shared by the research laboratories. An "undulating towfish" will be used to obtain geochemical information about water bodies during ocean research cruises and supply data for modelling activities.

The Provence-Alpes-Côte d'Azur regional council granted a scholarship to Ifremer for a research thesis on "the role of hydrodynamic forcing in the anthropogenic impact in Marseille" (3D modelling). The thesis is co-supervised by the University of the Mediterranean.

Marine **expertise** in the regions

Ifremer contributed to defining the marine components of the Regional observatory of biodiversity in the Languedoc-Roussillon region. Consultations were made on the indicators and existing knowledge inventoried in synergy with approaches on national and European levels, to establish a preliminary assessment for the regional council's choices. Ifremer also cooperated in the study mission for the creation of a marine nature park on the Vermilion coast.

Our Institute took part in drawing up the summary on the uses of the marine environment and territorial stakes in order to establish a location plan for wind turbines. It was coordinated by the Languedoc-Roussillon regional Prefect. To this end, maps were drawn up of constraints based on the spatial distribution of resources and fisheries use.

Ifremer's station in Corsica coordinated the European working group on marine litter in 2010. The studies resulting in the definition of "marine litter" macro waste for the Marine Strategy Framework Directive.

A study on contamination in commercial species (fish and crustaceans) by discharges from the Canari asbestos mine in Upper Corsica, was conducted in Saint-Florent gulf at the request of the Corsican environment office. It enables better understanding of the distribution of chemical contaminants at various levels in the food web and an assessment of the risk for consumers.

Expert assessment missions by Ifremer's Mediterranean centre were also commissioned, both on operations to extend aquaculture areas, particularly in the Bay of Lazaret in Toulon and on sanitary category rankings of shellfish production areas in the Bouches du Rhône county.

© Ifremer / M. Gouillou

Trawling cruise for marine litter study

An activity linked to the **regional** economy

Once again, in 2010, the year was marked by high mortality of oyster spat. Teams from the Institute monitored the phenomenon in Corsica and relayed information from national research programmes.

Ifremer took part in organising the Conference on Marine and Coastal Economy held in December 2010 in Toulon, attended by numerous stakeholders from maritime and industrial realms. Our presentations focused on marine renewable energy sources and mineral resources. Furthermore, our Institute participated in the Regional shellfish farming conference organised by the Mediterranean regional shellfish farming section.

All year long, working in partnership with the Corsican environment office, Ifremer observed the fishing activities in lagoons. This study is part of the fisheries information system framework. It provides invaluable data on production in these particularly sensitive environments which are representative on the scale of the island.

Cooperation with the SNCM ferries company to deploy drifting buoys on trips between Marseille and Corsica made it possible to record surface current data to validate forecasting models for currents between Corsica and the mainland.

© Thierry Nectoux / Chambre Noire

Maritime economy meetings in Toulon

Projects with the PACA Marine Cluster label

- Vasque (water quality monitoring AUV): a project to design a hybrid underwater vehicle based on a motorised version of the Sea Explorer Glider dedicated to coastal activities in shallow water. It is coordinated by the ACSA firm and associates ACRI, Ifremer, the Marseille oceanology centre and the Villefranche-sur-Mer oceanology observatory;

- Squid (safe and quick underwater intervention device): a project to develop pooled technologies a reconfigurable device for different types of deep sea response operations. ACSA is project leader and the Lhéritier company, Ifremer and CNRS INSU are associated partners;

- Paramills (simulation for optical image formation) is a project to perfect a new acoustic detection system designed to transmit data between two mobile underwater devices, one of which is an AUV. It is coordinated by Ixwave, with the Semantics and ECA companies as partners of Ifremer and UPMC.

- The SJB (secondary junction box) definition and installation on the cabled network of Antares observatories was completed. Deploying this junction box makes it possible to have a cabled seafloor observatory for oceanographic research technological trials, without disturbing the Antares observatory while connecting and disconnecting equipment.

Developments and transfers from research

Industrial contracts were signed with marine finfish farming enterprises in the region, to create hybrid individuals of interest for aquaculture. A start-up (Coldep) working in the field of microalgae extraction and dissolving industrial CO_2 was created to develop business applications of patents from the Mediterranean centre.

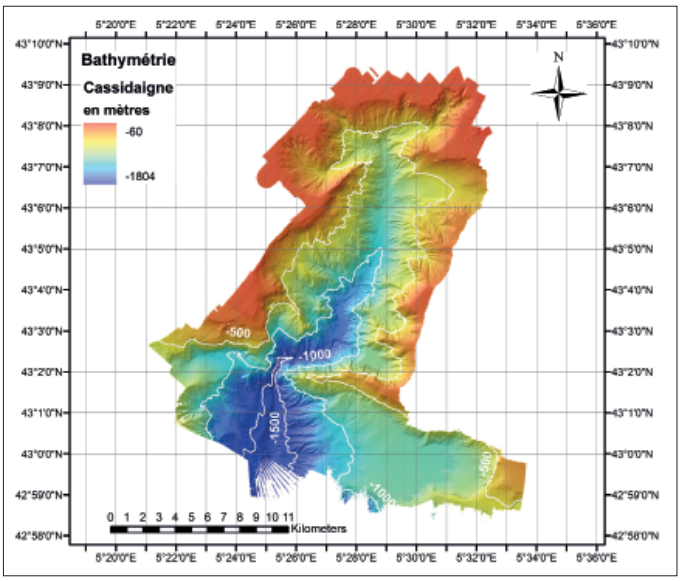
PACA Marine Cluster **partnership**

Several projects approved in 2010 are carried out in partnership with regional economic stakeholders. For the most part, they have the PACA marine cluster seal of approval and are financed by the single inter-ministry fund and supplemented by local and regional authorities. The federating programme "services for the marine strategy" whose coordination is ensured by Ifremer, led to a joint PACA marine cluster-AERMC call for projects on ecological restoration of deteriorated environments.

Reorganisation of research activities in the Languedoc Roussillon around three joint research units

- UMR EME, a joint research unit on exploited marine ecosystems, involving fisheries science teams from Ifremer, IRD and University of Montpellier II;
- UMR Ecosym (UM2, CNRS, IRD and Ifremer) with contributions from immunology and physiology teams;
- UMR Intrepid (integrated and ecological intensification for sustainable finfish farming), set up by Ifremer and Cirad.

Ifremer teams took part in teaching activities at UM2, CNAM, Creufop and at the IUT for chemistry.



Bathymetry in Cassis canyon (Mediterranean)

On the initiative of the Regional delegation for research and technology (DRRT), the University of Corsica and Ifremer worked on drawing up a collaborative research project with two lines of study: relationships between anthropogenic pressures on catchments and phytoplankton communities in lagoons; developing a platform for modelling complex natural systems (larva, algae, pollutants, etc.) in the channel of Corsica. The dossier will be submitted to the programming commission in 2011, to receive funding in the 2007-2013 state-region contract framework.

The Caromed research group working on the ecology of canyons and deep rocks in the Mediterranean includes Ifremer, the University Pierre & Marie Curie and the Marseille oceanology centre. Its objective is to study biodiversity in these areas which are shelters for fish species.

International meetings

Highly significant scientific activity focused on blue fin tuna all year long, with Ifremer's participation in CITES, ICCAT working group on stock assessment meetings, studies on electronic tagging and monitoring from the air. The management decisions taken were in compliance with scientific opinions.

A conference on the French ocean research fleet was held in Marseille. This gathering, held along with a meeting of the fleet scientific and technical committee, facilitated discussions on fleet resource trends with respect to scientific programmes, on target assessments for creating valuable uses for the scientific data collected and on the cost of seagoing facilities. Ifremer teams also took part in the conference of the International commission on scientific exploration of the Mediterranean Sea (CIESM).

© Ifremer / P. Gontier

The Franco-Japanese symposium on interactions between "Fisheries, aquaculture and the environment", organised in cooperation with the University of Kinki, was held in Sète in September 2010, with one hundred participants, scientists and managers.

Partnerships in overseas France

Overseas, Ifremer's activities are based on three major priorities, defined in its four-year contract. These are: research action to underpin the sustainable development of local production supply chains; observation and monitoring activities to underpin public planning policies; and research to better exploit and utilize the scientific added value of overseas environments, particularly in the fields of biodiversity and marine renewable energies.

An orientation given high priority in the strategy engaged overseas is the setting up of stronger scientific cooperation between Ifremer teams in overseas France and those in metropolitan France, and partnerships with universities, research bodies and local and regional associations. Ifremer is also aiming to develop scientific cooperation with neighbouring countries in the area and thus contribution to the regional integration of French ROM-COM overseas regions and authorities.

Above and beyond the activities conducted in our various locations, Ifremer has actively participated in studies done locally and in metropolitan France in the frame of the National research and innovation strategy in overseas France (StratOM).

Our Institute also shows a strong presence at majors meetings and events, on regional and international levels.

Overseas France, high stakes in terms of resources

France ranks second worldwide as a maritime nation, with over 11 million square kilometres of exclusive economic zones, 97% of that area being accounted for by maritime waters of overseas France. France's overseas regions and authorities represent significant stakes for resources, both current (fisheries or aquaculture) and emerging (biodiversity, mineral and energy resources). Ifremer has been traditionally present there with 10% of staff posted in locations in the Indian Ocean (Réunion), French West Indies (Martinique), Saint-Pierre-et-Miquelon and French Guiana, as well as in the Pacific (French Polynesia and New Caledonia).

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Ifremer's Pacific centre

FRENCH GUIANA

In 2010, shrimp production continued to drop, while coastal fisheries and southern red snapper production progressed. Shrimp fisheries must cope with both economic and biological difficulties, since the latest assessment showed a decrease in stock.

Sustainable development of coastal **fisheries** in French Guiana

The initial results of the Dépêche action for sustainable development of coastal fisheries in French Guiana, which began in 2009, highlight the economic difficulties in this supply chain, which is leader in terms of fishery production in Guiana. With co-funding from ANR, an Ifremer PhD thesis based on a bioeconomic approach to these fisheries was set up in partnership with CNRS.

On the initiative of Ifremer and CNRS, a Marine sub-group was created within the Irista Scientific Interest Group to gather all research stakeholders in French Guiana. A workshop for discussions between scientists, socio-professional delegates, State services, local authorities, NGOs and others was organised for the occasion in October 2010.

© Ifremer / Guyane

Sampling of shrimp

© Ifremer / O. Dugornay

Core samples taken on dives to study subsea sedimentary facies in Robert bay in Martinique

WEST INDIES

The national strategy for a coherent and integrated maritime policy in overseas France led to the setting up in the French West Indies, and other outermost regions of France, of Overseas maritime councils in 2010. Ifremer works along with them, with research being given its full due thanks to the input of scientific knowledge and expertise in coastal and marine management. Following on from commitments made in the Grenelle environmental summit meetings, relayed by the Grenelle marine summit, the Martinique regional council has kicked off a pilot project for ocean thermal energy conversion (OTEC) which is part of its regional programme for energy efficiency and management.

Aquaculture, an inter-DOM programme

The Genodom programme's objective is to validate and optimise the management inter-DOM (between French overseas counties) of the gene pool of red drum. Two new experimental zones were commissioned in the Martinique station, co-financed by the EFF and the regional council; a diagnosis kit was tested on broodstock (Trident project), in collaboration with the Palavas LARL laboratories and in partnership with an industrial firm. Studies on controlling artificial breeding of red drum (assisted fertilisation) and on aquaculture's potential environmental impacts were complements to this programme. The laboratory provided its support for the local supply chain by delivering nearly one million larvae to the three private-sector hatcheries in Martinique and Guadeloupe.

© Ifremer / O. Dugornay

Red drum fish farming

© Ifremer / O. Dugornay

Pot samples taken to study fish fauna in Robert bay (Martinique)

Fisheries information system

In 2010, organising the fisheries observatory (FIS) continued, with the outsourcing of activities in Guadeloupe to an operator, validation of data collected and the protocol for the monitoring of landings in Martinique in compliance with the national standard and regularly publication on line of the newsletter on fishing vessel activity in the French West Indies. Ifremer also took part in a working group to assess large pelagic species stocks (blue marlin with Cicta; mahi-mahi or common dolphinfish with CRFM and Cicta). In addition, funding from Interreg Caraïbe was granted for the multidisciplinary Magdelesa programme on development of sustainable moored fish aggregating device (FAD) fishing in the Lesser Antilles arc.

© Ifremer / O. Dugornay

Studying toxicity of algae on larvae of marine species

Monitoring marine environmental **quality**

Contamination of the marine environment by chlordecone is continuing and will continue to mobilise numerous resources both locally and in metropolitan France. Above and beyond conducting two specific studies on chlordecone behaviour and fate in sediment and in living organisms, Ifremer fully played its role of scientific expert for both State services and maritime professionals. The support provided contributed to defining a second series of measures for fisheries management aiming to limit populations' exposure to this contaminant. In order to prepare the second national action plan for 2011-2013, Ifremer presented its research studies to the working groups on pesticides of Guadeloupe and Martinique, with the Health department director in attendance.

The Fort de France bay contract was signed on 7 May 2010. Ifremer is a member of the bay committee and of the scientific council. It is on the steering committee of the network monitoring water quality and the aquatic environment in the bay. Our Institute also carries out missions to help implement the WFD.

SAINT-PIERRE-ET-MIQUELON

Ifremer is the only research organisation present in the Saint-Pierre-et Miquelon archipelago. The delegation there informs the relevant research teams about local needs and requirements, since most actions are carried out with strong support from research units in metropolitan France.

Assessing fisheries resources in Saint-Pierre-et-Miquelon

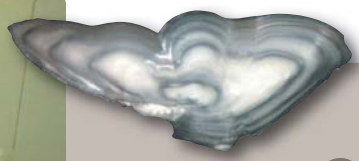
Each year on a local level, since 1970, Ifremer has compiled the biological data needed to determine total allowable catches (TAC) and quotas for fisheries (cod, snow crab, sea cucumbers, swordfish and whelk) which provide the local fleet with activity. Working with a reference lab in metropolitan France, technical preparation was ensured for a vessel from the archipelago to fish burrowing bivalve molluscs in 2011. In 2010, a local representative took part in scientific assessments of fisheries resources on the south coast of Newfoundland around the Saint-Pierre-et-Miquelon archipelago. These studies have been regularly conducted in cooperation with Canada since the Franco-Canadian fisheries agreement was signed in 1994.

Collaborative work was set up between Ifremer's Sclerochronology age determination laboratory and the Canadian department of Fisheries and Oceans (DFO) at St. John's, to investigate age and growth estimations in cod. In the framework of Ocsan, Ifremer resumed genetic identification studies to trace the origin of salmon caught in professional and recreational fisheries. A technical case file was drawn up with DFO for the chartering of a local boat for a scientific cruise to assess pectinid stocks (king and queen scallops) to be conducted in 2011.

© Ifremer / H. Goraguer

Taking otolith specimen from cod

Otolith



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Preparing a lantern net to monitor growth of mussels

Pectinid farming, a unique overseas value chain

Since the collapse of cod stocks, followed by the 1994 moratorium which reduced landings by about 90%, some local stakeholders have turned to aquaculture.

Ifremer provides scientific support for pectinid (giant scallop) farming stakeholders in a project including hanging culture on ropes and seeding of juveniles in deep water, being developed at Miquelon with financial support from Odeadom. Several actions were carried out, such as seabed mapping, hydrodynamic modelling, technological developments for monitoring and acquiring environmental data. In August 2010, an Ifremer mission was delegated to determine which of the dredging gears available in the archipelago represented the best compromise between scallop harvests and sustainably managing the environment. The experimentation will continue in 2011 with trials on site. This pectinid farming supply chain which is unique overseas, was presented during the conference on sustainable tropical island aquaculture held in Tahiti in December 2010.

INDIAN OCEAN, RÉUNION AND MAYOTTE

French Exclusive Economic Zone in the Indian Ocean cover a surface area of 2.8 million square kilometres, including Réunion, Mayotte and the TAAF French Southern and Antarctic territories grouping the Antarctic islands and districts and the Scattered islands. Ifremer is contributing to the sustainable development of French maritime activities in the Indian Ocean and to protecting the environments and natural marine heritage of islands there. Our Institute intends to be a partner in the Réunion regional scientific maritime cluster (PRM) whose establishment is currently being studied.

© Ifremer / J Bourjea

Northern slope of Europa (Scattered Islands)

Assessing fisheries **resources** in the Indian Ocean

The fisheries information system (FIS), being a permanent network to monitor fisheries activities and catches, makes it possible to draft summaries for use by State services or international organisations (e.g., the IOTC), to manage these activities and the exploited stocks.

The Espadon project has eight international partners including Australia, South Africa, Thailand, the Seychelles and India. The study's objective is to determine whether there is a single stock or several stocks of swordfish in the Indian Ocean. The results from genetic analyses (performed on 3,000 samples) will be available in late 2011. The project is co-financed by the European Union, the regional council of Réunion, the French State and Ifremer.

Balanced management of deep sea resources exploited by small-scale coastal fisheries in Reunion Island (comet groupers, tropical red snapper, brilliant pomfret, and so on) is vital for the sustainability of this activity. The Démersaux project aims to assess these groundfish stocks. Funding for it was established in 2010, associating the EFF, the State, the regional council and Ifremer, working in collaboration with CPMR.

© Ifremer / L Le Rû

Reunion Island long-liners fish in the intertropical zone, targeting large pelagic species (mainly tuna and swordfish)

Monitoring Réunion **coastal** water quality

Ifremer is in charge of coordinating WFD implementation, working closely with the Dreal regional directorate and Onela, the French national agency for water and aquatic environments. Ifremer works collaboratively with many specialists on coral, benthic macrofauna, reef fish, tropical ecotoxicology, and so on, to define the appropriate indicators for coastal ecosystems in Réunion Island.

Development is underway for several hydrodynamic models to anticipate the impact of discharges from water treatment plants and industries along the coast, as a function of the wind conditions, duration of discharge, flow rate, concentration, etc. This modelling platform is co-financed by the European Union, regional council, water office, and Dreal regional directorates for the environment, planning and housing. It will equip the future regional marine scientific cluster of Réunion, with the FIS, Ifremer's secure databases (Quadrige, Sextant and Harmonie) and the genetics analytical laboratory.

© Ifremer / J Bourjea

A whale and her calf, intrigued by a juvenile green turtle

Management assistance tools for **marine protected areas**

The Pampa project to create a balanced score card to assess and monitor the performance of marine protected areas (MPA) will enable the monitoring, as of 2011, of the efficiency and effectiveness of the management of the Natural marine reserve Public Interest Group in Réunion (GIP RMNR). Ifremer, Ifrecor, MPA Agency and GIP RNMR are co-financing its development.

The CAMP (connectivity of marine protected areas) study is using a population genetics tool to determine the paths of exchanges between the various coastal zones in the South West Indian Ocean (SWIO). Recommendations on a more or less densely arranged network of MPAs will be presented to the Indian Ocean Commission (IOC) in late 2012. The project is co-financed by the European Union, regional council, Diren directorate, Ifremer and Wiomsa.

Marine renewable energy sources (**MRE**) on Réunion

The Réunion Island delegation has greatly contributed to defining the overseas France component of the national MRE technological platform whose creation is now underway. The local team should ultimately be able to support pilot projects in Réunion carried out in the frame of the local Gerri programme which is led by the local authority.

Marine **turtle** conservation

Studying the migratory paths of sea turtles between their nesting grounds and feeding grounds, including the deployment of twenty-five Argos beacons, is done is partnership with the Kelonia marine turtle observatory. The objective is to help Ifremer and our partners draw up scientific recommendations for establishing the marine turtle conservation plan in the French exclusive economic zones and territories in the Indian Ocean. The plan will be implemented by the competent State services at Réunion, Mayotte and the Scattered islands (DEAL Réunion, DEAL Mayotte and TAAF) and will enable a French action plan to improve the conservation of these currently endangered species to be put into application and coordinated. The main feature of this plan will be its basis on the Memorandum of Understanding on the conservation and management of marine turtles and their habitats of the Indian Ocean and South East Asia (Iosea MoU), signed by France in 2009 and which is seeking to achieve a regional approach to the conservation of these migrating species.

Research and development: **pooling means** and resources

The Litto3D® project (SHOM, IGN) launched in 2009 aims perform 3D mapping of the French coastal areas in the Indian Ocean. Data are acquired using an airborne laser scanner (Lidar). The TAAF, AAMP and Ifremer are joining forces to equip the Litto3D® flights with a hyperspectral scanner. The project (Spectrhabent) is designed to develop and verify the efficacy of a mapping method using remote sensing of coastal habitats to monitor changes in these ecosystems. Réunion Island was chosen as a pilot site.

In the framework of the Orcasav project, an experimental cruise was performed in 2010 to test the effectiveness of fish pots designed to catch Patagonian toothfish. A boat was chartered by a consortium of shipowners from Réunion. Monitoring of technological aspects was performed by Ifremer's Fisheries science technology lab and of biological aspects by the MNHN national museum of natural history and CNRS. The project was given the Qualitropic and Brittany marine competitiveness clusters' seal of approval. It is co-financed by Ifremer, the Reunion longliner freezer shipowners' council, the single inter-ministerial Fund and the Regional councils of Brittany and Réunion. Outcomes are expected in mid-2011.

Developing tropical aquaculture

Ifremer's laboratories in Palavas-les-Flots, Martinique and Polynesia are contributing to research and development projects in the Indian Ocean, working in collaboration with the Réunion island association for the development of aquaculture (ARDA) and the Association for the development of aquaculture in Mayotte (Aquamay), with the main objective of developing the local finfish farming activity: consolidating fishfarm protocols (Ombrigen, Génodom and Trident projects); developing prepared food products; making farm structures more reliable (cages and closed loops, ARDA's AquaOffshore projects).

In 2010, Ifremer made its contribution to the technical definition of the future Aquamay research and development centre in Mayotte, whose construction will begin in 2011. Scientific staff from Ifremer should be posted there in late 2012, once construction is complete, in the framework of a multi-annual agreement for scientific support from Ifremer for Aquamay.

Ifremer's Pacific centre

FRENCH POLYNESIA

In spite of the context of instability, numerous projects for the economic development of French Polynesia were started and were continued in 2010. Setting up the "Rahatu" committee (local body for the Grenelle marine environment forum), led to formalising the priorities which were jointly acknowledged by the State and the Pays local authority. Several of these priorities directly involve Ifremer and our scientific partners, such as pursuing research to support the sustainable development of pearl farming, aquaculture and marine renewable energy sources; setting up marine environmental monitoring networks in Polynesian lagoons; enhancing the value and utilisation of natural marine resources.

Although highly significant research results were produced by the existing partnerships (GDR Adequa, SPE), 2010 was a particularly rich year in initiatives aiming to federate research between the scientific partners working in French Polynesia or over the entire Pacific (GOPS, UMR EIO, Équipex and LaBex).

In February 2010, Marie-Luce Penchard, Minister of Overseas France visited Ifremer's Pacific centre. The delegation from the Ministry was accompanied by the President of French Polynesia, the High Commissioner and several Polynesian ministers.

Tahiti Aquaculture 2010 seminar on "Sustainable aquaculture in tropical island environments"

This international event was jointly organised by Ifremer, the government of French Polynesia and the Secretariat of the Pacific Community (SOC) and held in Tahiti in December 2010. The event attracted one hundred-eight participants, many of whom were ROM and COM representatives. This initiative was awarded the Ifremer 2010 trophy for scientific mediation (see page 5).

Pearl farming, a major economic activity in French Polynesia

The results obtained in the pearl farming field over the past five years by Ifremer and our scientific partners were presented to all professionals and managers in the supply chain during a conference-discussion held in March 2010. At this meeting, the research orientations proposed by Ifremer for the next few years were validated. They included optimising spat collection, selecting donor oysters for grafting to produce high quality pearls, farming practices and grafting techniques.

Studies by Ifremer labs led in particular to the filing of a patent for perfecting a coated nucleus for cultured pearls.

Genetics laboratory

Farming pearl oysters

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Aquaculture rearing of the batfish Paraha Peue (Platax orbicularis)

Marine **finfish farming**

Research carried out by Ifremer, in close collaboration with the regional fisheries service (SPE), led to the transfer of rearing techniques for Paraha peue (*Platax orbicularis*) farming to a private fish farm set up on the Tahiti peninsula. In addition, construction continued in 2010 on the Vaia technical centre for aquaculture, with considerable support from Ifremer in designing the facilities and in training the scientific and technical staff. The cooperation agreement set up between Ifremer and SPE was renewed for the 2010-2011 period.

Marine renewable **energy** sources

Ifremer's activity carried out to support the development of MRE in French Polynesia was materialised through several projects in 2010. The outcomes of a study on tidal stream power launched in 2010 on the Hao atoll located in the Tuamotu archipelago, will direct the choice of stream turbine prototypes to be set up in the channel there. Three other requests for Ifremer's scientific collaborative work on MRE projects took form in 2010, with the Pacific Otec company's ocean thermal energy conversion project to set up a 10 MW platform at sea offshore from Tahiti; the Sedep firm's project for a wave power plant demonstrator at Papara (Tahiti) and a project for a biomethanisation plant using algae on the Paihoro-Taravao site (Tahiti).

In addition, the Tahiti Fa'ahotu innovation cluster, where Ifremer is an active participant, was approved as a "business cluster" this year. A tripartite cooperation agreement was also signed with the marine clusters of Brittany and Provence-Alpes-Côte d'Azur.

Monitoring the marine **environment**

In 2010, Ifremer started scientific studies in the framework of a partnership with the laboratory for environmental studies and monitoring (LESE) at the Institute of radiation protection and nuclear safety (IRSN). These studies aim to develop a method to measure and monitor chemical contamination in Polynesian lagoons based on using pearl oysters as a sentinel species.

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Algae room

Ifremer's main partners in the Pacific

2010 was a year for many Ifremer partnerships to be consolidated or begun in the Pacific:

- studies by the GDR Adequa research group on pearl farming with ten partners from Polynesia and metropolitan France continued;
- the South Pacific integrated observatory for environment and terrestrial and marine biodiversity (GOPS), now joined by seventeen French partners made up of universities and national and regional research institutions;
- the project to create the Ocean island environment UMR joint research unit with the University of French Polynesia, IRD and Louis Malardé Institute, whose application was officially filed at Aeres in October 2010;
- submission of a joint application for the Équipex call for tender with the GOPS partners (French Polynesia and New Caledonia) in September 2010;
- submission of a joint application file to create a "Labex Corail" laboratory of excellence bringing together the main French research teams specialised in the field of coral.

NEW CALEDONIA

In April 2010, the creation by the government and the State of a research and innovation strategy committee (Cosri-NC) and a scientific and technical committee (COST) laid the foundations for a local research and innovation strategy which will be useful for the economic, social and cultural development of New Caledonia. In addition, the University and research bodies present in New Caledonia (BRGM, IAC, Ifremer, IPNC and IRD) began to study the creation of a PRES university research cluster.

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Farmed Litopenaeus stylirostris *blue shrimp*

"**Lagoons** of New Caledonia" work site studies

The ramping up of the multidisciplinary work site study on "New Caledonian lagoons" which is part of the "system-based approach and site studies" programme as well as Ifremer's four-year contract, continued in 2010. Scientific partnerships were established or strengthened thanks to joint responses to calls for tender and the first studies carried out:

- methodology guides for monitoring marine environmental quality (financed by ZoNéCo) and for monitoring of impacts from mining (financed by CNRT on "Nickel and its environment"),
- value development of Quadrige/Surval tools (coastal environment monitoring) and presentation of the demonstrator,
- study on how people frequent and use lagoons and marine protected areas (linked to the Pampa project); underwater video surveillance of MPAs in the South Province (eight hundred hours acquired),
- drawing up specifications for setting up a permanent fisheries monitoring network (FIS) on lagoons in New Caledonia (financial support from ZoNeCo),
- bioprospection cruise to find microorganisms in atypical environments on the New Caledonian coasts, in partnership with Institute Pasteur (co-financed by the Ministry for Overseas),
- studies begun on the hydrodynamics numerical modelling platform, in collaboration with IRD,
- and a report published in December 2010 on a halophyte and mangroves inventory, produced in partnership with Queensland University (Australia) and financed by the Pacific Fund.

New Caledonian lagoon

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For sustainable **shrimp farming** in New Caledonia

2010 was the final year of the scientific programme schedule under the 2007-2010 framework contract of the Déduction project involving Ifremer, the French State and the government and provinces of New Caledonia. The sector is currently undergoing numerous difficulties. Therefore, an additional clause to the 2007-2010 framework contract validated the continuation of this project in 2011, considered as a year of transition and consolidation while awaiting the audit of the supply chain and the New Caledonian shrimp farming meetings.

In 2010, the Déduction project produced significant advances, i.e. better characterisation of the virulence of two pathogens affecting the supply chain; more thorough knowledge about the ecophysiology of larval phases and the utilisation of a promising technique for the rearing of broodstock. Action in the form of think tanks, consultation, studies on clinical monitoring and experimental trials (probiotics, antibiotics, etc.) were conducted to cope with the crisis the hatcheries are undergoing. The Stylog database for the monitoring of shrimp farms was successfully transferred to the Aquaculture farms group (GFA).

Research and expertise within the French and European marine science network

INTELLIGENCE AND FORESIGHT STUDIES: PREPARING TOMORROW'S FUNDAMENTAL RESEARCH THEMES

The major prospective study carried out with twenty-four partners (ministries, industrial firms, research bodies, the European Commission, etc.) in 2010 concerned marine mineral resources by 2030. Its objective is to identify the stakes, the potential of these resources, their exploitation and utilisation in the medium-term, so that the appropriate strategic programmes and partnerships can be engaged. Four types of potential resources were selected: hydrothermal sulphides, cobalt- and platinum-rich seamount crusts, polymetallic nodules and natural hydrogen sources.

Remima prospective study on marine mineral resources by 2030

Ifremer is leader in this study which mobilised some thirty experts who were asked to analyse the numerous determinants to be taken into account to cover the scientific, economic, strategy (security of supplies) and legacy (long term resources) aspects related to the exploitation of these resources. The summary will be published in early 2011. Ifremer has conducted research in this sector for a long time and thus acquired both experience and expertise, particularly in the field of marine metallogeny, international cooperation with other countries which are potential partners or competitors (Russia, Brazil, etc.), of sea-going facilities (vessels and underwater vehicles and technology), partnerships with the oil industry (impact studies, biodiversity, deep sea ecosystems), and technological research on ways to explore deposits.

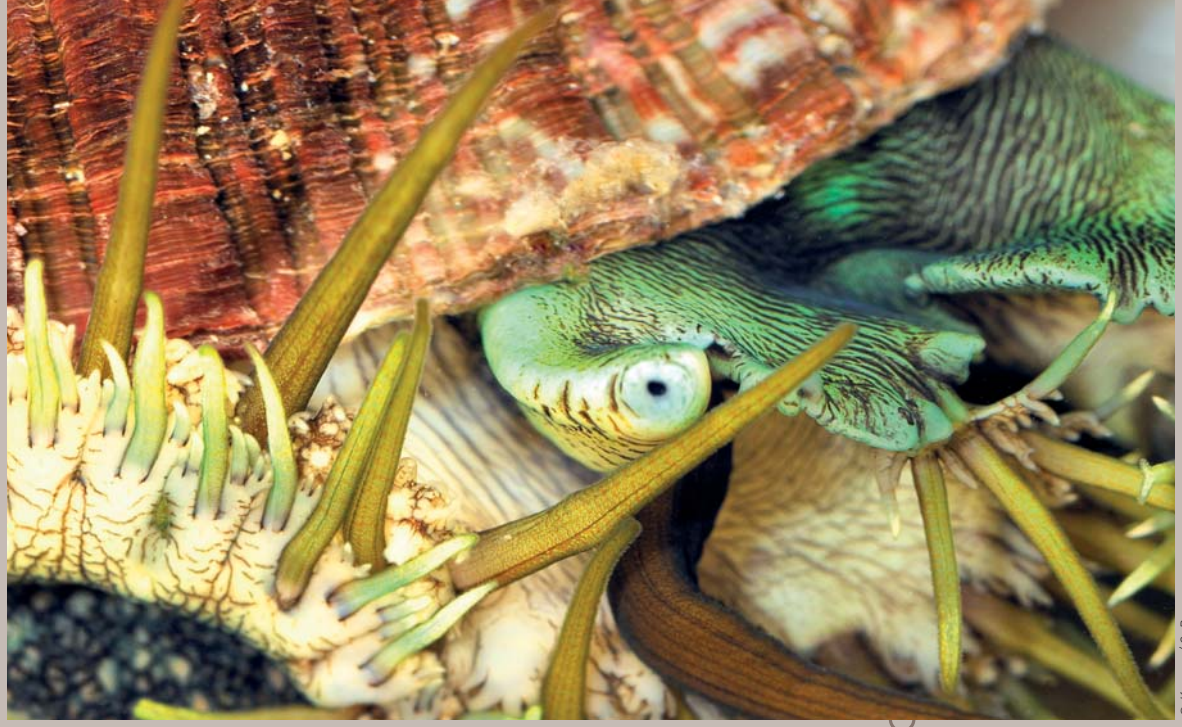
Ifremer is also an associate in the forward study think tank of the ANR's "Mediterranean partnerships and research" workshop which has fifteen partners. This workshop has been set up to select themes for research in the Mediterranean by the year 2030. After summarising eighty prospective studies and selecting the scientific themes to be addressed, specialised working groups were launched in 2010 and Ifremer is involved in most of them. The final report will be submitted to ANR in June 2011.

Research on biodiversity, **strategic** position

In 2010, Ifremer, with the support of the Ministry of ecology, sustainable development, transport and housing, led the collegial expert assessment entitled "What are the priorities for an Ifremer marine biodiversity research strategy?". The document was delivered to the Ministry in June 2010. It identifies Ifremer as the lead partner on the themes of biodiversity of toxic phytoplankton and deepsea ecosystems and recommends that our Institute take part in generic and cross-cutting projects.

Ifremer continued to finance the action on the "Coastal environment" theme (PNEC) in 2010, to the amount of 485,000 euros as well as actions of research groups for which its participation is considered to be especially strategic (255,000 euros).

The French coastal environmental research programme (PNEC) supports research on coastal areas in metropolitan and overseas France. This thematic programme involving several organisations (Ifremer, CNRS, IRD, Total, CNES, BRGM, Cemagref) focuses on understanding how coastal systems function. The general objective of its action is on the theme of coastal ecosystems functioning and services they provide in a context of overall change related



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to the climate, anthropogenic pressure and changes in uses. Ifremer steers its scientific committee. In 2010, thirteen projects were financed, two of which were proposed by our Institute.

The Aquadeb research group has been seen through to completion. It strongly contributed to giving Ifremer's activities on dynamic energy budget models greater visibility. The project was conducted in partnership with fourteen institutes and gave rise to the publication of two special issues of the *Journal of Sea Research*, as well as an international conference organised in Brest. It initiated a large number of collaborations.

In 2010, new GDR research groupings were set up, including the Marco (marine population connectivity) group sponsored by CNRS and Ifremer. The group's objective is to federate the French research teams specialised in the understanding of population dynamics and adaptation to the marine environment, in order to create a strict framework for the analysis and interpretation of molecular data. Thirteen research groups are involved, including eight universities, in metropolitan and overseas France.

Partnership-based **dynamics**

Ifremer has entered into a strategy of active partnership with research bodies and universities, which has led to the creation of joint research units (UMR). Evaluating and constructing new projects will further bolster and even broaden the existing partnerships. To this end, Ifremer has three new structures for its research activities in the Mediterranean, including an initial association of teams from the fisheries science research lab and those of IRD, which comprises the University of Montpellier II. Two other UMRs have been set up in Brest and overseas, respectively: the first has formed a large multidisciplinary group of national and international importance; and the second has reinforced the collaborative work already well rooted in the various projects underway.

Ifremer's mobilisation in the framework of the "investments for the future" calls for projects gave form and structure to partnerships which were sometimes just emerging. An example of this is LabEx Mer, initiated by the European institute of marine studies (IUEM), and sponsored by the European University of Brittany (EUB) research cluster PRES with support from the PRES UNAM (Loire region). LabEx is designed to bring together marine science education and research on a nationwide and European scale on the central scientific theme of "a changing ocean". Moreover, the LabEx Cote project (INRA, University of Bordeaux, Ifremer), focusing on the assessment of conditions of maintenance, evolution and adaptability for different, contiguous and interacting ecosystems to in the Aquitaine region is a clear and tangible example of the partnership between Ifremer and the University of Bordeaux in terms of environmental chemistry and ecotoxicology (Cochise SIG).

European and international cooperation

EUROPEAN UNION GUIDELINES

2010, as the central year of FP7 2007-2013, was one of great activity for Ifremer: sixteen projects out of thirty submitted were selected, making a success rate of 53%. A total of forty-eight FP7 R&D projects have been underway since 2007, with seven of them coordinated by our Institute.

This was also the occasion for the FP7 mid-term assessment, which highlighted the programme's structuring role and its contribution to building a European research area, while indicating a certain lack of legibility for some themes (the capacities programme in particular) and the overly complex administrative management aspects which persist.

Consultations of all the research institutions involved will be held during the first semester of 2011 on the new orientation proposed by the Commission for the next programme FP8 2014-2020, which will be based both on innovation and on the major societal challenges.

Joint **programming** initiative

In 2008, the European Commission proposed that Member States adopt a new approach called "joint programming" to boost the efficiency of European research which has remained too compartmentalized. Since research in Europe relies largely on national research, the Commission proposed that Member States coordinate their efforts and pool their resources in order to increase its impact. JPI Oceans, which Ifremer has promoted since 2008, now enjoys the support of sixteen Member States Its permanent secretariat is located in Brussels, under the leadership of the Research Council of Norway and with Ifremer's participation. JPI Oceans aims to create a knowledge base enabling an integrated policy to make the most of marine resources in a sustainable way, while improving our understanding and mitigating the impact of climate change on the marine environment and coastal areas.

"Europe 2020" strategy think tank document

Published on 3 March 2010 by the European Commission, the "Europe 2020" strategy for "smart, sustainable and inclusive growth" represents the European Union's new economic strategy for the next ten years, following on from the Lisbon strategy. One of the proposed measures, i.e. raising research and development investments to 3% of GDP, should contribute to achieving the Europe 2020 target. In this context, Ifremer has been contacted by the Ministries of research and of European institutions to launch the preparing of the next FP8 and the joint programming initiative for "healthy and productive oceans and seas" (JPI Oceans).

"Marine knowledge 2020" **communication**

Improving knowledge of the seas and oceans is one of the three cross-cutting tools of the EU's integrated maritime policy which was endorsed by the Member States in 2007. Indeed, knowledge about the marine environment contributes to achieving the objectives of the other two instruments, namely better spatial planning and integrated maritime surveillance.

The European Commission's communication on "Marine knowledge" published on 8 September 2010 presents the outlook for the marine data policy by 2020 as well as concrete actions for the 2011-2013 period. It recommends improving the reliability of knowledge about seas and oceans; reducing operational costs and delays for those who use marine data; and increasing competition and innovation amongst users of marine environmental data.

Ifremer, as a major stakeholder in the European marine data policy, has invested its efforts with DG MARE and the European Parliament to contribute to the implementation of this strategy.

EUR'Ocean 2010 Establishing research priorities and policies to be adopted for the next decade.

The seventh conference "EUR'Ocean 2010: Grand Challenges for Marine Research in the Next Decade", jointly organised by the Marine Board of the European Science Foundation, the Belgian presidency of the European Union and the European Commission, was held in Oostende, Belgium.

The Oostende declaration, which was adopted in October 2010 by the European marine science and technologies community, calls upon the European Union and its Member and Associated States to address the seas and oceans grand challenge by:

- adopting joint programming in marine sciences;
- developing a European Ocean Observing System;
- establishing appropriate mechanisms to keep under review current marine and maritime research programmes and projects with a view to enhancing their impact.

At this conference, Ifremer presented the marine and maritime research opportunities in the sectors which correspond to the major challenges for society.

Oostende Declaration presented to Commissioner Máire Geoghegan Quinn after its adoption at the end of the Eur'Ocean 2010 conference (13 October 2010, Ostend). Left to right: Lars Horn, Wim De Vos, Máire Geoghegan Quinn, Kostas Nittis and Edward Hill

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Facilities policy... a major role for Ifremer

Opportunities for European Integration projects for research infrastructures which came into being with the calls of the FP7 Capacities programme gave Ifremer the possibility to gain an even stronger position as a major stakeholder in this field. In 2010, the three new projects of Jerico, Marinet and Aquaexel were added to those already underway.

All these projects develop and utilise Ifremer's expertise on the European scale in its mission to develop and operate research facilities for French or even European communities of marine science researchers.

International **Seabed** Authority

Stretching beyond the French continental shelf is a huge extent of seafloor which the United Nations declared as "Common heritage of mankind" (covering nearly 70% of the earth's seabeds) through the UN Convention on the Law of the Sea in 1982. States which wish to undertake activities related to mineral resources there must first obtain an exclusive permit from the intergovernmental organisation called the International Seabed Authority.

Ifremer has held a fifteen-year permit since 2001 to explore for polymetallic nodules. In 2010, the ISA adopted a new regulation concerning sulphide deposits. The French State decided to exercise its rights in these areas and mobilised by creating the Comes, etc., in order to file for a permit in the South Atlantic zone. Ifremer was designated as the operator.

Ifremer's representation in **Clora**

The Club of associated research organisations (Clora), which Ifremer is a member of, was created to facilitate the action of French universities and public research bodies with respect to European Union institutions, in the fields of research, technology, innovation and training. During the year 2010, the Clora fulfilled its missions of collecting and disseminating information about European research policies and programmes. It has strengthened its ties with the permanent representation of France to the European Union. A working group was created to prepare the next European Framework Programme for research and innovation.

Ifremer was increasingly present during 2010 with respect to DG Environment, DG Enterprise and the new DG Energy. Finally, the permanent secretariat from the Joint programming initiative "Healthy and productive seas and oceans" was set up in Brussels, with the help and support of Ifremer's liaison office at Clora.

Debate in European Parliament

Along with its G3 partners (German IFM-Geomar, UK NOCS) Ifremer co-organised a high level debate at the European Parliament in March 2010, on "European marine ecosystems, what we don't know about them, the role of research on the 2012 targets and beyond, etc.

The event was chaired by Corinne Lepage, Member of the European Parliament, Vice-chair of the Committee on Environment... and Chair of the Parliamentary Intergroup on Seas and Coasts. It brought together European MPS, decision-makers and researchers to discuss the contribution of marine sciences and technologies to building the foundation of knowledge required for the successful implementation of the European marine environmental policy.

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Cooperation with **Brazil**

The significant expansion of new emerging countries, particularly on marine environment research and development themes, means there are new players on the world scene.

Brazil has acquired a genuine scientific project focusing on marine studies (including ecosystems and geology) over the entire Brazilian coastline.

Since Ifremer's four-year plan provides for the development of lasting scientific partnerships with Brazil in the field of geosciences and the deep sea environment our Institute delegated a mission to assess the research potential of the Federal Government, Brazilian states and the Brazilian Petrobras oil company, a historic partner of Ifremer. An overarching Franco-Brazilian cooperation strategy has been developed and should lead to formalisation of framework agreements with the institutes and universities considered to be the most relevant. This collaborative work gave rise to the Sanba cruise at the end of the year, whose objective was to determine the nature of the crust along the Santos basin (winning the Ifremer 2010 trophy for industrial partnership).

Cooperation with **China**

Cooperation with China in the field of marine geosciences has existed for a long time. Examples of it are seen in the training at Ifremer of several Chinese PhD students, and joint cruises and research projects. Today, the China Geological Survey (CGS) is considered to be the leader in this field in China. This organisation also works with SOA organisations (FIO in Qingdao and Comra), with which Ifremer has signed a framework agreement for cooperation.

In order to develop constructive cooperation with China in this field, the G3 partners (NOC, IFM-Geomar and Ifremer) have joined forces, on Ifremer's suggestion, to create the technical conditions with CGS for balanced cooperation.

European (G3) and Chinese (CGS) marine geoscience research scientists attended a scientific workshop held to identify potential themes for cooperation. Five themes were chosen: gas hydrates, sedimentary and coastal processes, mineral resources, subsea CO_2 storage and technological developments. An agreement was signed between G3 and CGS instituting the implementation of marine science cooperation.

The first concrete operation will be the joint submission of a proposal in response to the European International Research Staff Exchange Scheme (Irses) call for proposals which will finance exchanges of researchers between European organisations in G3 and the Chinese research bodies associated with the project built upon the gas hydrates theme.

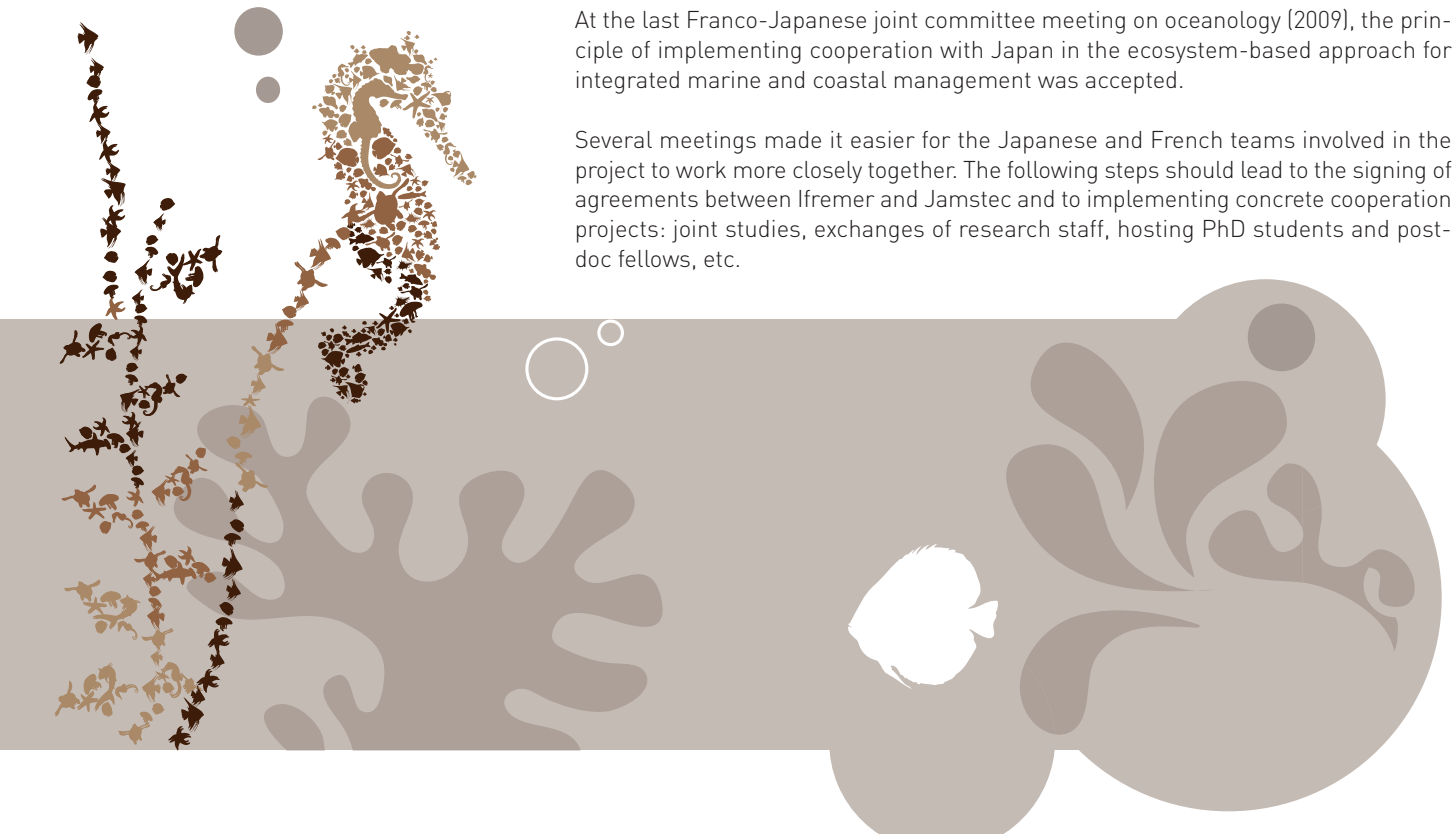
This joint operation between European institutes is the first of its kind. It highlights the complementarity of Ifremer's European and international activities.

Cooperation with **Japan**

For several years now, scientific cooperation between Ifremer and Japan has been strongly based on the core activities of the Japan Agency for Marine-Earth Science and Technology (Jamstec), i.e. physical oceanography, subsea exploration, deep sea ecosystems, and so on.

At the last Franco-Japanese joint committee meeting on oceanology (2009), the principle of implementing cooperation with Japan in the ecosystem-based approach for integrated marine and coastal management was accepted.

Several meetings made it easier for the Japanese and French teams involved in the project to work more closely together. The following steps should lead to the signing of agreements between Ifremer and Jamstec and to implementing concrete cooperation projects: joint studies, exchanges of research staff, hosting PhD students and post-doc fellows, etc.



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Sète and its surrounding area (Mediterranean)

Scientific cooperation in the **Mediterranean**

Scientific cooperation in the Mediterranean is achieved both in the context of bilateral programmes involving Ifremer and its research counterparts on the southern shores and though the specific EU instruments designed to foster the bringing together of various countries. In 2009 and 2010, Ifremer was involved in two of these programmes.

In June 2010, the European delegation in Ankara assigned the France, Spain and Netherlands group the environmental twinning programme with Turkey, to apply the Water Framework Directive and monitoring. This is Ifremer's first success in twinning with a Mediterranean country, highlighting the importance of its thirty years of experience in the coastal environment.

The ENPI CBC Mediterranean sea basin programme for 2007-2013 is a multilateral initiative for cross-border cooperation which in financed in the frame of the European neighbourhood and partnership policy. Its aim is strengthen the EU's relationships with its neighbouring countries and to promote a sustainable and harmonious cooperation process over the Mediterranean Sea basin by highlighting its endogenous potential. Ifremer tendered proposals on two themes: chemical contamination in the Mediterranean and improving integrated management of Mediterranean lagoons.

Closer collaboration with **Romania**

Following a meeting with the scientific service of the French Embassy in Romania and the Romanian GeoEcoMar institute in September 2010 in Bucharest, Ifremer set up a cooperation model with Romania combining research and training (Erasmus, PhD and Master's theses) in partnership with the Universities of Brest, Marseille and Montpellier, etc. Furthermore, it was decided that the geoscience collaboration with GeoEcoMar and the University of Bucharest would be redefined on the bases which have been established since 1995.

Cooperation with countries on the **southern shores** of the Mediterranean

Algeria

In the framework of the first Franco-Algerian academic and research conference, the Algerian Minister of higher education and scientific research (MESRS) and the French Embassy in Algeria organised three days devoted to the assessment and the outlook for scientific cooperation between the two countries. Ifremer took part in the day devoted to research institutions. This meeting confirmed Algeria's will to grow the resources of its institutes in terms of researchers, budgets, programmes and cooperation.

Morocco

In July 2010, Ifremer's Brittany centre received a delegation from the Moroccan National institute of fisheries research (INRH). This was the occasion to discuss Ifremer's support in setting up a fisheries information system in Morocco.

Missions to Morocco in 2010 focused on collaborative work underway dealing with the management of coastal monitoring data and the Quadrige information system.

Tunisia

A working meeting was held with the National institute of marine sciences and technologies (INSTM) in November 2010 at Ifremer's head office. A review of cooperation in 2009-2010 showed positive outcomes, with nine articles on research published in international journals and two papers presented at scientific conferences. The meeting was followed by a visit to the Ifremer station in La Tremblade.

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Visit by Ridha M'Rabet, the Director of the Tunisian national institute of marine sciences and technologies (INSTM), led by Tristan Renault

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Studying the economic value of **marine ecosystems**

Ifremer provided a salaried staff member on secondment to the Blue Plan, linked to the United Nations Environment Programme's action plan for the Mediterranean. This was its contribution to the first exploratory study carried out on this scale in the Mediterranean. Five types of marine ecosystems were studied, each of them characterised by its biodiversity, surface area covered and by the ecological services it supplies. Since data and universally used accounting rules are lacking, the economic values obtained to estimate these services are based on numerous hypotheses. However, the outcome of the study does give reasons to encourage the protection of marine systems and to continue the research.

Strategic **networks**

Ifremer's contribution to the European Science Foundation (ESF) highlights its specificities in terms of marine sciences and their significance within the scientific community in Europe and worldwide. Through its contributions to ESF Marine Board analyses, Ifremer is also behind the EU policy for research infrastructures which has been developed over the past five years. Our Institute reaped the benefit of its advances by becoming the coordinator of several European flagship projects, the most recent of which (Jerico) deals with coastal observation infrastructures.

As coordinator of the Aquamed project on behalf of the Efaro (fisheries and aquaculture) network, Ifremer has worked to encourage a regional approach to data collection which is being set up and for more attention to be devoted to aquaculture in the Mediterranean.

By participating in the EurOcean platform, Ifremer is rising to the challenge for data and information to serve the needs of institutions and scientists, as relayed by all European maritime policy stakeholders in the Oostende declaration.

Finally, our Institute's participation in the POGO and EuroGOOS networks keep it fully abreast of developments in international projects for ocean observation, both in the field of data (Ifremer being the operator of the Coriolis centre) and that of sensors or systems (Argo, OceanSites).

COLLABORATIVE RESEARCH ACTIVITIES IN THE EASTERN ENGLISH CHANNEL

Sustainable **management** of fisheries

In the framework of the ERA-NET MariFish Channel regional programme, Ifremer worked on sharing VMS data from fisheries fleets operating in the English Channel so that they could be disseminated as aggregated data. Following a meeting organised by Ifremer, the Department of the Environment, Food and Rural affairs (Defra, UK) and the French directorate of maritime fisheries and aquaculture (DPMA) decided on the policy to be implemented for the use of these VMS data in monitoring fishing activities, including in marine protected areas and no-take zones between France and the United Kingdom.

An agreement signed at the start of 2011 validated the following scenarios: all VMS data in the Channel to be shared by French and British governments (between Ifremer and Cefas by delegation); sharing on a monthly basis of aggregated data supplied by processing of logbooks and other sources of fisheries information.

Modelling marine ecosystems

Seeing the growing interest for integrated models to understand and predict how marine ecosystems function and respond to change, Ifremer organised international workshops in the frame of two collaborative programmes, including that for the Mediterranean region. The workshops kicked off thought and discussion on the harmonisation of the so-called end-to-end models and their application in various management plans. The conclusions were presented with their integration in ERA-NET joint programmes or calls for projects in mind.

In the framework of the MariFish call for projects, Ifremer teams were chosen to receive ANR funding in two of the three projects selected, i.e. Badminton and Reproduce.

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4

Life at Ifremer

Human resources

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Strategic **workforce** planning

As an integral part of the four-year contract, strategic workforce planning in the form of occupation and skills forecasting (GPEC) manages and develops human resources to ensure that our strategy and expertise are in step. This approach aims to better link Institute activity with skill sets, current job positions and future hiring.

At the outcome of the pilot programme conducted for six months in various departments and services, several tools were developed or updated:

- A job map was created which will cover all typical jobs at the Institute once complete.
- The scientific thesaurus, listing all the specialities of Ifremer's salaried staff (our "knowledge capital") was simplified, for greater efficiency.
- Managerial benchmarks, describing the essential skills for managers in detail, are being drawn up.

A new GPEC process is being implemented, with the objective of making updating and anticipation of needs easier and ensuring greater transparency.

Finally, in an evolving legal context, the Seniors project aims to recognise the skills of employees in the senior age class, to transmit their knowledge and expertise and to build the second part of their career path, with them. This fifteen-month project will be led by a national referent.

The GPEC project was presented to the functional managers on 8 November and to the trade unions on 9 November. The new GPEC process will come into effect at Ifremer in the first quarter of 2011. New tools will be finalised by the end of 2011.

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2010 Seminar for newly hired employees organised at the Brittany centre

Bargaining with trade unions

The negotiations focused on the following topics:

- Fixed-term contracts with a specified purpose: negotiations were conducted with the trade unions.
- Annual appraisals: the template packet was revised and new items include the definition of the employee's main assignments and current activities and the implementation of provisions related to the Seniors agreement (professional appraisal interview, tutoring).
- 2010 payroll measures: since no agreement was reached with the unions, measures were implemented by the management in application of the pay policy agreement signed on 2 April 2007. They enabled a general pay rise of 0.15%; financing of individual promotions to the amount of 0.81% per level; allocation of an individual merit bonus of 313 euros to 25% of staff and proceeding with seventy-one choice-based promotions and thirty-eight seniority-based promotions.

Psychosocial risk **prevention**

The issue of preventing psychosocial risks came to the fore as a true challenge in 2010. The representative trade unions were asked to negotiate an agreement whose objectives are to prevent stress and violence in the workplace and to improve the well-being and mental health of employees. The bargaining has already led to a number of points of convergence being established.

- An inventory was taken.
- The scope of negotiations covers both Ifremer and Genavir in the economic and social unit (UES) framework, and more widely covers all psychosocial risks and not just stress.
- Two sessions of training were provided for the participants in negotiations, one organised for staff delegates and the other for the general secretaries and human resource managers.
- "Note 2001" on the procedure for helping salaried employees who are experiencing difficulties has already been updated.

Five bargaining meetings were held in 2010 with the aim of reaching an agreement in the first quarter of 2011.

The quality approach and the sustainable development progress plan

The overall **Quality** approach: ISO 9001 certification

Implementation of an overall Quality approach, making ISO 9001 certification an objective in the 2009-2012 four-year contract for the entire scope of Ifremer, continued over the year, by defining and validating the approach and beginning to deploy it. A Quality project officer was appointed and the network of quality delegates was supplemented to cover all centres. A team of in-house auditors was also created.

The headquarters and several laboratories and departments were either certified or had their accreditation renewed as of 2010, and other certifications are planned for 2011.

The overall certification approach was engaged in early 2010, with the first meeting to launch the project, followed by a diagnosis of all Ifremer activities in March and April (ten sites, fifty-seven departments and services, eighty-five people met). In May 2010, the new overall management map was presented to the general management, which made it possible to validate all the processes of production, management and support.

After a training course, in September 2010, the facilitators of the various working groups began the description of all processes and the related performance measurements, to be effectively set up in 2011.

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Sustainable development progress plan

In the context of the national strategy for sustainable development, Ifremer wants to play a role combining exemplarity, impetus and promotion. It is continuing the approach begun three years ago, through a progress plan which was defined and validated by the Board of Directors. The plan is comprised on sixty actions distributed over all the geographical locations, and concerning all fields, i.e., energy, transport, waste, water, buildings, managing green spaces, etc.

Calls for tender: there is now a note on "Sustainable development" in the tenders for contracts for cleaning of premises, which take the service firm's certifications, its sustainable development policy or employing people with disabilities into account. Likewise, calls for tenders concerning waste management include questions on how it will be processed.

In the field of transport, several company or inter-company travel plans, which promote solutions of shared shuttles and carpooling, were finalised in 2010.

Developing videoconference resources and mobilising the employees have made it possible to significantly reduce the amount of travel. Amongst new developments, lightweight videoconferencing systems have been installed in our smaller locations (overseas DOM, Corsica, etc.).

Number of video-conferences per year-Number of connections

The Lorient site was the first to have its carbon reporting scoped and will be followed by Boulogne-sur-Mer and Port-en-Bessin, as well as four other sites in 2011.

For waste management, which is both an environmental and social commitment, paper is now given to work-integration social enterprises that are in charge of recycling it as profitably as possible. Moreover, all our Institutes sites use 100% recycled paper and selectively sort their rubbish.

Energy consumption: by performing energy audits and installing the appropriate equipment, consumption of energy and fluids were stabilised, in spite of the increase in our buildings' surface areas.Measures were also taken in managing green spaces, such as mowing less often, eliminating use of chemicals, planting wild flower meadows and recycling of waste.

Certifications and accreditations in 2010

- ISO 9001 certification of the headquarters was confirmed in April 2010.
- confirmation of accreditation of the La Tremblade genetics and pathology laboratory's analytical unit, on the "animal histopathology" programme
- confirmation of the previous accreditations of the Environment and Resources laboratories and the Equipment and material testing laboratory
- The initial audit was carried out for the accreditation of the Port-en-Bessin Environment and Resources laboratory for nutrient analysis.
- Quality approaches continued for hydrological monitoring (nutrient analyses), in Nantes and Arcachon, with an accreditation audit planned in 2011, as well as in Sète.
- Quality approaches aiming for the accreditation of activities related to monitoring for the Biogeochemistry and ecotoxicology department were finalised and approaches continued in the Environment, Microbiology and Phycotoxins department.
- confirmation in 2010 of ISO 9001 certification for the Vessels and shipboard systems service in "Design, development, maintenance and dissemination of embedded software aboard ocean research vessels and underwater vehicles"
- The Quality approach continued in order to obtain ISO 20000 certification of the IT and marine data department.
- Genavir received its ISO 9001 certification in March 2010.

In the short to medium term, the objective is to integrate part of the existing certifications within the overall quality system.

Communication : raising everyone's awareness about marine sciences

Reasserting Ifremer's ambition and position whilst enabling the broadest public to both understand our Institute's research work and take ownership of it, are the two objectives set for the Communications department in the four-year contract. These are objectives that Ifremer endeavoured to fulfil in 2010, through the development of new internet and intranet sites, educational and awareness-raising activities, and participation in events organised for "2010, international year of biodiversity", which was a unique opportunity to present scientific research and results with our partners.

Web portal, facilitating access to scientific information

The web portal's complete overhaul was launched in 2010. A new editorial, graphics and technical structure now delivers more accessible, dynamic and attractive content for internet users. It is easier to browse the site thanks to a technical tool development (eZpublish); and over two hundred new pages of presentations have been created. Spaces devoted to specific audiences (press, professionals, elected officials and decision-makers) have both increased our Institute's visibility and made the work of its teams easier. With the will to better disseminate scientific information, especially to young people, the new section called "Discover the oceans" focuses on information for the general public and pupils and students.

Scientific **outcomes**, the cornerstone of Ifremer's communications

Disseminating scientific results starts with the regular presence of various Ifremer teams and researchers at conferences and professional or trade events. In 2010, the symposium on "Marine sciences and policies" organised on a MEEDD initiative in close cooperation with Ifremer, Crape/CNRS, Onema and the Agency of marine protected areas attracted over three hundred scientists and managers to La Baule. As the main partner, along with the periodicals *Le Marin* and *Les Échos*, Ifremer took part in organising the 6th meetings on the coastal and maritime economy.

La Pérouse library, serving the scientific community

In 2010, Archimer logged 540,000 downloads of theses, publications and reports by Ifremer's scientists and engineers.

In a context where the way people do documentary research is changing and moving towards digital resources, La Pérouse library has improved its website and online access, with a complete overhaul of its documentary portal and the migration of its documentary information system (DIS) to an Oracle server. Over 200,000 articles were downloaded in 2010 and the new version of Ifremer's open institutional archives Archimer now holds more than 9,000 references with full texts. The library has begun an activity of prospective and strategic intelligence, as well as "information mapping" services, for researchers, heads of laboratories or department managers. In addition, the number of entries was doubled by organised events and fitting-out of the lobby.

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La Pérouse library in Brest

Increased **media** presence

Press kits sent to and largely relayed by the media (with a pick up rate of nearly 14%) contributed once again this year to increasing Ifremer's visibility for the general public. The Orcasav experimental fisheries cruise (joint communication with TAAF, MNHN, CNRS) attracted great interest from the media, as did the BIG and Ovide ocean research cruises or Ifremer's scientific interventions in Haiti, *inter alia*. The *Xynthia* storm put the theme of waves in the news, and the Wise symposium, "Ifremer riding the wave" was widely quoted in the press. The same held true for the first Ploops cruise, whose haploops crustaceans raised a buzz with journalists.

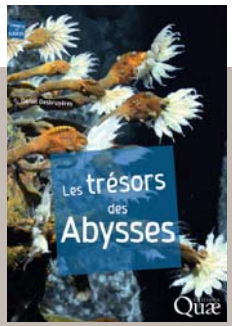
The partnership with the weekly *Le Marin* was renewed in 2010, with the quarterly publication of *Nouvelles de l'Ifremer* alternating with *Les Rendez-vous de la biodiversité marine*, a monthly page published for the International year of biodiversity.

Finally, Editions Quaé published seven new Ifremer books in 2010 and sold nearly four thousand publications, promoting them to the media (press and radio) and at many fairs, round tables, festivals and symposia. Amongst the most sought-after publications are *French maritime economic data 2009* (under the editorial coordination of Régis Kalaydjian), *Les trésors des abysses* (written by Daniel Desbruyères), *Les secrets des algues* (co-authored by Véronique Leclerc and Jean-Yves Floc'h) and *Gestion du trait de côte*, a publication produced in collaboration with the Ministry of ecology, sustainable development, transport and housing.

Energized in-house communications

The Ifremer Trophies, the overhaul of the intranet portal and the series of in-house conferences contributed to make communications within Ifremer more dynamic. The in-house conferences were facilitated by researchers from our Institute or partner institutions, addressing themes ranging from the major overhaul of *Victor 6000*, to biodiversity, to gliders used in oceanography or the development of aquaculture in overseas France.

Ifremer's new intranet was proposed in March 2010 and represents a big change in the way information is conceived and shared. This new collaborative space uses innovative technology (web 2.0) and innovative ergonomics, with the aim of better meeting the expectations of all Ifremer staff. Combining real-time syndication of information, a personal space and the possibility to network, the portal offers better visibility of activity within the institute and projects being prepared.



Meetings with the public on the theme of biodiversity

In association with the second "Sea days" event held in June, throughout year 2010 devoted to biodiversity, Ifremer organised numerous events.

The nationwide Cartes Com' campaign: to present the biodiversity of the seabed, 60,000 postcards were disseminated in nearly 700 public places in Paris, Brest, Nantes, Toulon, Boulogne-sur-Mer, etc.

The "young audience prize at the World festival of underwater pictures": organised in partnership with several organisations and aquariums (Nausicaa in Boulogne-sur-Mer, Océanopolis in Brest, the Oceanographic Institute and the Porte Dorée Tropical aquarium in Paris).

The "cartographic café": a novel and educational encounter around a sea chart, organised by Ifremer in partnership with Le café cartographique association, IGN, SHOM and MNHN.

The "Sea days in Paris" event: spotlighting the stakes and outlooks for the marine environment through an explanatory display, films, models of underwater vehicles used for exploration and a demonstration on the theme of bacteriological pollution.

The "Sea and enterprises meetings": a series of lectures on the theme of exploiting and managing marine resources, organised in close cooperation with the Secretariat general of the sea, the ESSEC business school and the Gazarts de la mer group.

"Open house on the beach" in Brest: twelve classes of schoolchildren went off to discover biodiversity, a guided walk on the beach followed by a workshop on the theme.

The BIG cruise website, with numerous sections including the logbook, videos, the nursery school children's blog, all updated daily by scientists for the cruise's duration.

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Participating in recruitment and information **fairs**

To increase the Institute's visibility for PhD students and young research scientists, whether French or European, the different departments presented Ifremer's activities in turn at the European Research career fair, the "Pari pour l'Emploi" forum for recruiting young graduates, and at a selected number of encounters for young researchers and enterprises of the "Bio Techno" network. A brochure was published to this end. Putting research work in general and marine sciences in particular in the forefront is also one of our Institute's missions. In 2010, this led Ifremer to participate in several trade fairs presenting occupations, such as Azimut (January 2010, in Brest), which is designed for high school students in their last two years of study, or the marine jobs and professions forum (December 2010, in Paris), which was organised by the Oceanographic institute.

International Year of **Biodiversity**

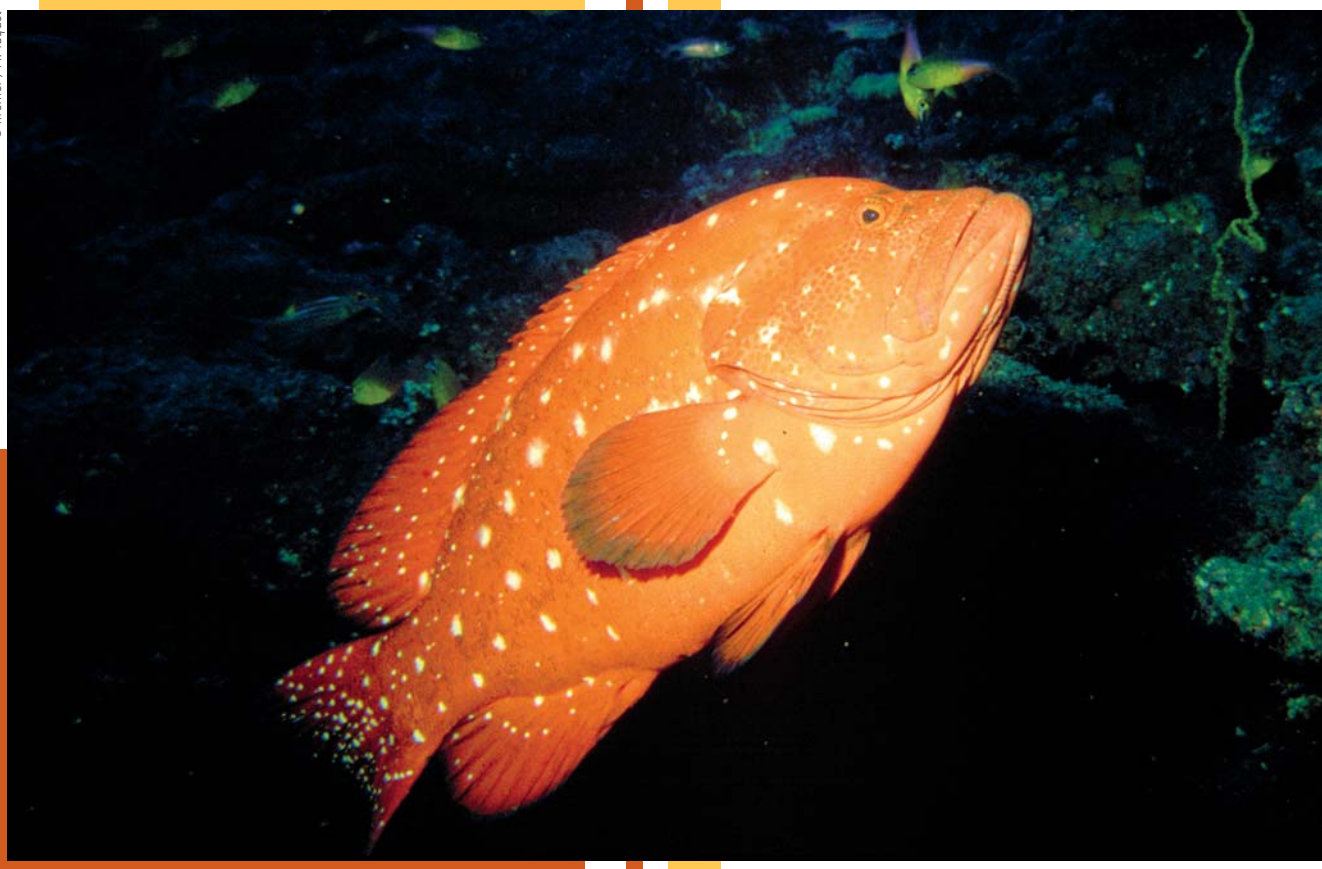
All year long, Ifremer's 2010 communications actions highlighted the wealth of marine biodiversity. The schedule of organised events, found on-line on the institutional website, received the MEEDDM seal of approval, as did *Rendez-vous de la biodiversité marine* published in partnership with *Le Marin* magazine. Ifremer took part in the "Sea days" and "Science festival" events (Sciences villages in Brest and Toulon, New Caledonia centre in Paris), as well as in MEEDM communications actions, such as the Big biodiversity quiz hosted in partnership with the *TF1* TV channel. And once again this year, workshops and scientific demonstrations and events (Exposciences in Loire-Atlantique, Science month in Brest, etc.), education projects and disseminating course material to teachers and so on, allowed a young audience to discover the wide range of marine resources and sciences.

"Cart' Com" operation during which 2 x 30,000 post cards were distributed in cultural venues and on tourist sites and in places where young people are present (682 distribution points in metropolitan France). Penetration rate (number of cards taken out of number of cards deposited): 97.4%

Teaching plans and material from primary to high school

In addition to the "Passport for research in the Loire Region" operation conducted in cooperation with the regional council, Ifremer invested efforts in new educational projects in 2010.

The "Space for the sea" framework was launched in May 2010. By following the races sailed by skipper Véronique Loisel, Ifremer, IRD and CNES give teachers the means to do classroom projects on marine sciences. A catalogue of classroom resources was created to this end. 2010 was also devoted to preparing the "Atlantique 2011" catamaran trans-Atlantic crossing, launched on the initiative of three young teachers. The first partnership was established in a high school at La Seyne-sur-Mer, with a presentation of our Institute and hands-on lab work. Finally, Ifremer has been solicited to build a cross-border educational project based on exchanges of French and German students.



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Financial information

and appendices

Activity indicators

Research and expertise at the heart of the French and European marine science communities network and serving economic development

	Objectives	Indicators	2010
1	Promote better structuring of French marine research	The proportion of publications by the alliance for marine science with respect to French, European and world production for oceanography, including Ifremer (LOLF P187)	405 80% (10%) 14% (1.8%) 5,4% (0.7%)
		Publication map for Ifremer associated with French partners and percentage of co-publications Share of co-publications with P187 operators	270, i.e. 67% 48, i.e. 12%
		Mean number of mentions made of Ifremer publications over three years (LOLF P187)	711 indicator 1.80
2	Be a driver of marine science policy in Europe	Number of European projects and rate of success for Framework programme research and development proposals (LOLF P187)	30 53%
		Percentage of coordination of European projects (LOLF P187)	13%
		Percentage of co-publications with European partners (LOLF P187)	139, i.e. 31%
3	Develop targeted international cooperation and strengthen the action in the Mediterranean	Map of international co-publications (including co-publications with the United States, Canada, Russia, Japan, Brazil, China and Mediterranean countries and co-publicationswith countries in Southern hemisphere, LOLF P187)	115, i.e. 28% 33, i.e. 8%
4	Optimise the links between public- and private-sector research	Percentage of contacts with firms in total resources (LOLF P187)	4.60%
		Number of private-sector contracting parties.	208
5	Make French research and expertise more responsive to the needs of society and public authorities	Scientific and technological papers and presentations in professional meetings	394
		Number of annual full time equivalent (FTE) posts mobilised to respond to public-sector orders for data, expert appraisals and opinions	397
		Number of published opinions and appraisals in response to an order made by public authorities (LOLF P187)	341
		Level of satisfaction of those requesting expert appraisals	NR
6	Make technological transfer activity more professional	Returns from fees/outside expenditures for filing patents and licenses (LOLF P187)	409,000 €/247,000 €
7	Raise awareness and encourage scientific teams to become more active in value and business development	Number of patents and software programmes in portfolio (LOLF P187)	69 patents + 21 software programs
		Number of licences/number of patents	33/69

Scientific programming to support strategic objectives

	Objectives	Indicators	2010
8	Learn more about ocean circulation to supplement the diagnosis of global change	Number of publications	45
9	Learn about and characterise marine biodiversity to better protect it	Number of publications	77
10	Develop knowledge and valorisation of biological resources through biotechnologies and bioprospection	Number of publications	19
		Number of patents	33
11	Contribute to sustainable fisheries and aquaculture	Number of publications	170
		Number of reports	
		Level of satisfaction of those requesting expert appraisals in fisheries and aquaculture	80%
12	Promote sustainable use of mineral and energy resources	Number of publications	72
		Number of reports	
13	Develop a global surveillance strategy, including both the high seas and coastal areas, to meet international and European challenges	Number of opinions and expert appraisals using monitoring	204
		Number of reports	
		Number of publications	68
14	Design and set up a nationwide system of environmental forecasting for changes in coastal environments	Number of publications	38
		Number of reports	
		Number of professionals using operational oceanography services	50 (OCO) 182 (OHO)
15	Implement a national and European strategy for marine databases	Number of extractions/consultations of marine databases on line	
16	Promote shared capacity for technological innovation	Number of instrument systems completed or transferred	32

Mobilising to meet challenges for Overseas France

	Objectives	Indicators	2010
17	Promote social and economic development of ROM-POM (overseas regions and local authorities) through scientific support for local sectors	Scientific and technological papers and presentations in professional meetings	138
18	Add to scientific knowledge about tropical environments.	Number of publications	16
		Number of reports	103
19	Pursue and develop observation and monitoring activities in response to demands by higher authorities	Volumetrics of databases for coastal, aquaculture and fisheries monitoring data acquired in overseas France	

A French oceanographic fleet serving research and marine exploration

	Objectives	Indicators	2010
20	Continue integrating the fleet in Europe and nationwide	Number of research scientists on board (French and from other countries)	463 (includ. 62 European)
		Number of publications from research cruises	94
		Number of days of scientific activity for the high seas fleet, including public service, cruises submitted to bids for tender and partnerships	679
21	Optimise fleet operations and facilities	Number of days high seas fleet commissioned	1,176
		Ratio of activity for high seas fleet/potential days	74%
		Coastal fleet: number of days at sea	971
		Ratio of activity for coastal fleet/potential days	58%

High performance operations

	Objectives	Indicators	2010
22	Develop the capacity to attract, assimilate and generate loyalty of valuable personnel	Percentage of employees, including French nationals, recruited outside of France (in accordance with Marie Curie grant criteria for eligibility)	
		Number of salaried employees holding an accreditation to supervise research	
23	Reinforce forecast-based management of jobs and skills	Signature of an agreement (milestone)	
24	Promote external mobility and develop hosting capacity	Number of PhD students (including foreigners)	197 (46)
		Number of post-doc fellows (including foreigners)	38 (15)
		Number of Ifremer salaried employees on external mobility for more than two months, including abroad	4
		Number of guests hosted for periods over two months, including foreign research scientists	13
25	Create instruments to recognise and award individual and collective performance	State of progress for the approach (milestones)	
26	Develop a multi-annual financing vision to meet scientific programming targets	Percentage of contractual resources (LOLF P187) Producing multi-annual plans (milestone)	26%
27	Broaden the modernisation of the Institute's financial management by providing stronger management support for scientists	Annual certification of accounts	
28	Reassert Ifremer's ambitions and positioning	Number of mentions in the media.	4,812
		Consultations of Ifremer's web sites	229,797
29	Provide understandable and empowering information about Ifremer's work for the broadest public	Number of communications actions	1,352
30	Draw up Ifremer's sustainable development progress plan	Composite MEEDDAT indicator (fluids, energy, video-conferences, etc.).	309 kWh/m^2 1,291 video-conférences 70% waste recycled
31	Aim for quality certification throughout Ifremer	Rate of renewal for certifications obtained.	1 extension 10 renewals
32	Make assessment an integral part of the organisation's operation, at every management level.	Rate of assessment for Ifremer units	4 evaluated units
		Number of outside experts solicited for assessments	

Financial performance for the 2010 fiscal year

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Ifremer had total resources in 2010 of 245.06 million euros, i.e., down - 3.82% from 2009 (€254.79 M).

Not including internal transactions, Ifremer's total resources for 2010 amounted to 212.85 million euros, making a decrease of - 1.28% compared to 2009, which corresponds to a drop of - 0.90% of subsidies granted for public service charges (SCSP) and of - 2.37% of contractual resources.

(1) Depreciation and book value of assets sold. A reminder that these account items have no impact on the Institute's balanced budget.

Total resources (in thousands of euros)

Total resources	2009	in % of total	2010	in % of total	2009 - 2010 trend	Variation in %
Subsidies for Public Service Charges (SCSP)	159 657	62.66	158 216	64.56	- 1 442	- 0.90
Programme 187 : Research in the field of environmental and resource management	146 581	57.53	147 816	60.32	1 235	0.84
Programme 113 : Urban planning, landscapes and biodiversity	2 403	0.94	2 461	1.00	58	2.42
Programme 154 : Sustainable management of agriculture, fisheries and rural development	3 387	1.33	4 321	1.76	934	27.59
Programme 206 : Food safety and sanitary quality	4 138	1.62	3 469	1.42	- 669	- 16.16
Programme 172 : Multidisciplinary scientific and technological research	148	0.06	148	0.06	0	0.00
Programme 315 : Exceptional public investment programme	3 000		0	0.00	- 3 000	-
Contractual resources	55 958	21.96	54 632	22.29	- 1 326	- 2.37
TOTAL BEFORE INTERNAL TRANSACTIONS	215 616		212 848		- 2 768	- 1.28
Book value of assets sold	516	0.20	2 644	1.08	2 128	412.08
Year's depreciation/amortization – internal transactions	38 661	15.17	29 564	12.06	- 9 097	- 23.53
TOTAL RESOURCES	254 793	100	245 056	100	- 9 737	- 3.82

In view of these means, Ifremer's consolidated expenditure for 2010 was 245.91 million euros, i.e., down - 1.76% from 2009 (€250.32 M). Not including internal transactions, Ifremer's consolidated spending for 2010 was 213.70 million euros, which was up +1.21% from 2009 (€211.14 M).

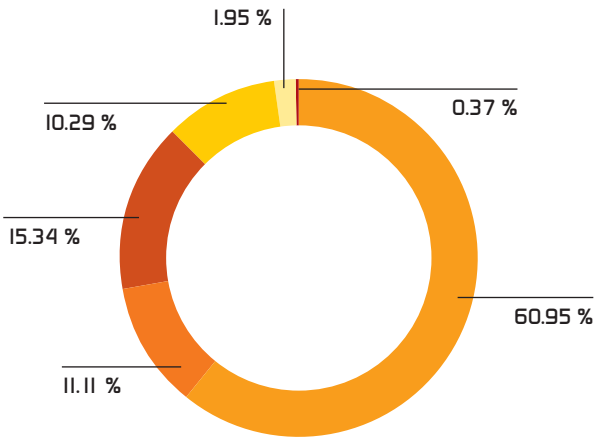
This trend in expenditure includes a rise in staff costs, representing an increase of + 0.74 million euros. After that, it is mostly related to increased resources allocated to scientific programmes (+ 1.64 M€) to fulfil our Institute's mission in the framework of performing its four-year contract and so that the targeted resource levels are reached.

A presentation of expenditure broken down into the three main types of expenditure highlights payrolls' significant share, representing 51.07% if strictly Ifremer staff are considered and 61.57% taking Ifremer and Genavir personnel into account.

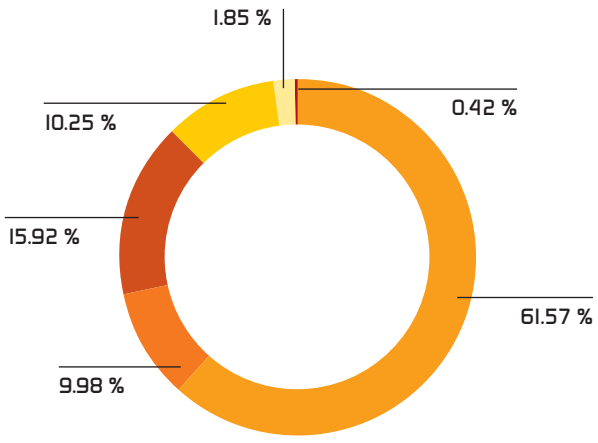
Total Expenditure (in thousands of euros)

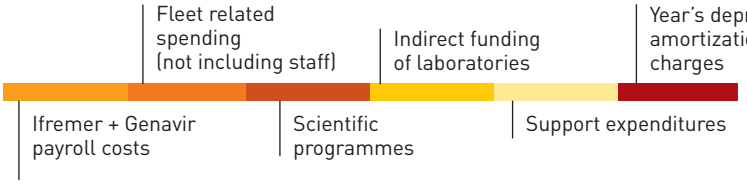
Total	2009	2010	Trend in volume	Variation in %
Payroll costs (Ifremer)	108,398	109,139	740	0.68%
Fleet related spending	43,756	43,778	22	0.05%
Scientific programmes	32,380	34,016	1,636	5.05%
Indirect funding of laboratories	21,724	21,907	183	0.84%
Support expenditures	4,109	3,956	- 154	- 3.74%
Year's depreciation/ amortization - operating charges	777	907	-	-
GRAND TOTAL NOT INCLUDING INTERNAL TRANSACTIONS	**211,144**	**213,703**	**2,559**	**1.21%**
Book values of assets sold	516	2,644	2,128	NS
Year's depreciation/ amortization – internal transactions	38,661	29,564	- 9,097	- 23.53%
TOTAL	**250,322**	**245,912**	**- 4,410**	**- 1.76%**

Detailed budget performance
(not including internal transactions) in 2009



Detailed budget performance
(not including internal transactions) in 2010





Resources

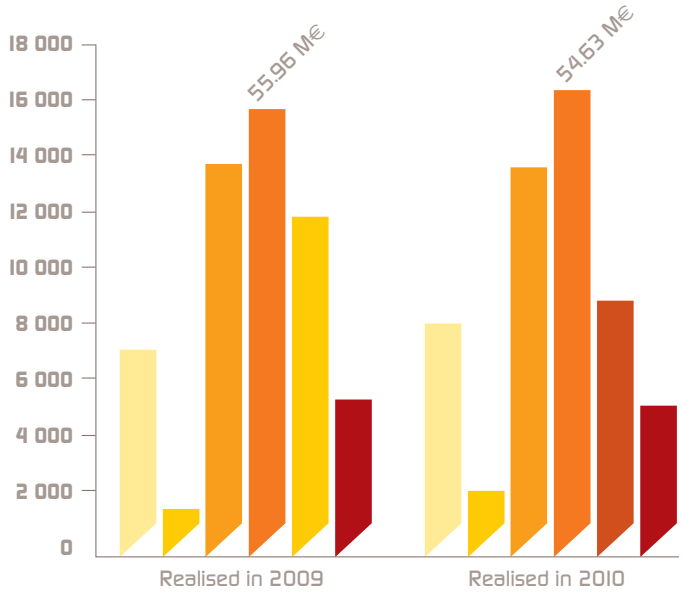
Operations

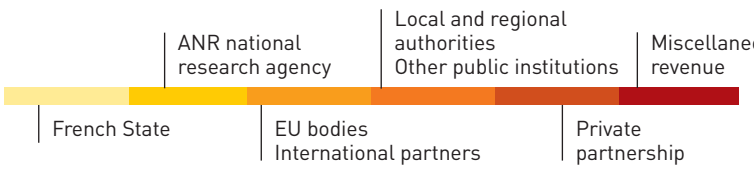
Ifremer's operating resources in 2010 reached 224.84 million euros, i.e., down - 1.76% from 2009 (€228.87 M). Not including internal transactions, these operating resources for 2010 were 192.63 million euros, which was up 1.55% from 2009 (€189.69 M).

This rise, not including internal transactions, is mainly the result of the following factors:

- the increase in the grant received for public service charges related to programme 187 (+ €3.31 M between 2009 and 2010), related to partially unblocking finances which had been credited to the reserves under the LFI finance act budget for 2010;
- the fall in equity (- €0.91 M), for which the two things in particular should be taken into account:
  - firstly, the specificity of the contractual resources for 2009, which included in particular the income related to deployment of the fleet in the framework of the operation to search for Air France's Airbus aircraft which crashed into the sea off the shores of Brazil.
  - secondly, work done by our teams in the framework of the Futuna operation, related to exploring and highlighting the natural resources of the seafloor off Wallis and Futuna, and to funding of the Extraplac research programme for the continental shelf extension conducted directly alongside the Futuna cruise, since it was implemented offshore from Wallis Island.

Trends in contractual resources presented by sources of funding 2009/2010 (consolidated contractual resources)





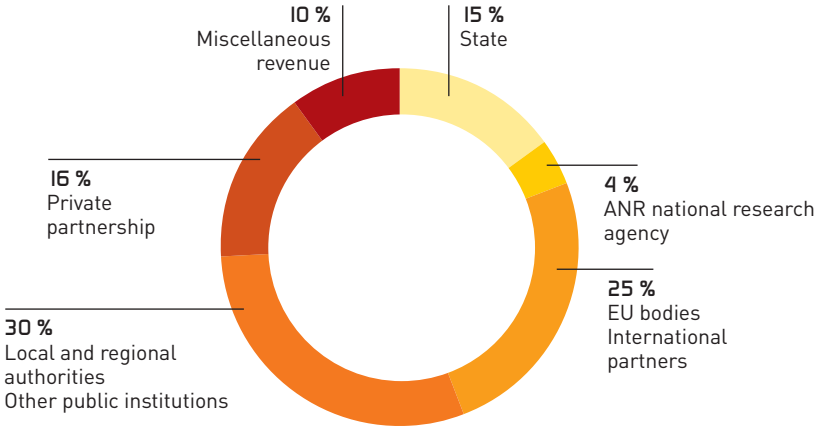
Investments

The drop of investment resources in 2010 compared to 2009 represented -5.70 million euros.

This trend is mainly due to posting in 2009 of the entire SCSP funding related to performance of 315 "Exceptional public investment programme" to the sum of 3 million euros. Subsidies financing the TGIR Atelier and TGIR very large research infrastructure facilities were indeed entered in the 2009 accounts, while the actual expense was spread over the two financial years of 2009 and 2010.

Contractual resources for 2010 (€5.18 M) showed a slight drop compared to 2009 (- €0.41 M). They remain very directly linked to the participation by local and regional authorities (under State-Region project contracts) in funding the following programmes: Prévimer in the framework of operational oceanography programmes, upgrading of the test tank in Lorient, the Ifremer-Genavir logistics platform in Brest, fitting out and equipping the CETSM centre and completely renovating and building an extension on the Bouin site.

Relative weight of contractual resources in 2010
presented by source of funding
(consolidated resources – excl. internal transactions)



Expenditure

Operations

Operating costs for fiscal year 2010 amounted to 223.90 million euros. Not including internal transactions, they were 191.69 million euros for 2010, an increase of 4.72% from 2009 (€183.05 M).

Ifremer's operating costs can be broken down into three large groups:

- Ifremer payroll expenditure, including temporary staff costs, which reached 109.14 million euros in 2010 compared to 108.40 million euros in 2009, thus progressing by + 0.68%.
- The total sum of operating costs related to the Fleet (Genavir contract, implementation of the Eurofleets agreement, contribution to RV *Beautemps-Beaupré*'s operation) was 38.77 million euros in 2010, making an increase of 19.80% compared to 2009 (€33.48 M). This rise is mostly due to increased scheduling and programmes, carrying out the Wallisplac public interest cruise and successfully developing partnerships based on the Futuna and Sanba cruises.
- Other operating costs (scientific programmes, laboratory resources, logistics and central services) amounted to 43.78 million euros. This first increase seen with respect to 2009 (+ €1.49 M) is the result of the rise in appropriations allocated to scientific programmes (+ €1 M).

Investments

Utilisation of payment appropriations during the fiscal year reached 22.01 million euros (not including own work capitalised), which was down by -€6.08 M€ from 2009.

This trend is mainly due to the completion in 2009 of three major investment programmes for our Institute: upgrading of RV *L'Atalante*, the starting up of operations for the national reference laboratory for "shellfish microbiology" in Nantes and making the scientific supercomputer available to the community of oceanography scientists.

In 2010, since the structure of investment spending remained identical to that of previous financial years, the main points to note are:

- a drop in funds used by the fleet,
- stability of means allocated to facilities and infrastructures,
- a rise in charges inherent to conducting scientific programmes, in particular, with the implementation and development of chemical testing and operations engaged to renew equipment and facilities and cover the needs of teams working in the frame of contract-based operations.

Total expenditure of Ifremer (in thousands of euros)

Consolidated expenditure	2009	% in 2009	2010	% in 2010
Ifremer + Genavir payroll costs	128,127,425	60.68%	131,582,931	61.57%
Fleet related spending (not including staff)	24,026,596	11.38%	21,333,844	9.98%
Scientific programmes	32,380,148	15.34%	34,016,251	15.92%
Indirect funding of laboratories	21,723,979	10.29%	21,907,104	10.25%
Support expenditures	4,109,351	1.95%	3,955,690	1.85%
Year's depreciation /amortization - operating charges	776,874	0.37%	907,402	0.42%
GRAND TOTAL NOT INCLUDING INTERNAL TRANSACTIONS	211,144,373	100%	213,703,222	100%

On the balance sheet, Ifremer's financial performance for 2010 is shown by the following elements:

- the income statement shows a positive balance of 0.937 million euros
- the working capital was topped up to the amount of 2.07 million euros.

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Profit and loss account for the year

YEAR END BALANCE SHEET BEFORE APPROPRIATION OF NET INCOME

ASSET	2010 Gross	2010 Depreciation and provisions	2010 Net	2009 Net	2008 Net
Intangible assets	**29,862,546.02**	**22,455,525.62**	**7,407,020.40**	**7,059,425.34**	**14,570,446.64**
Start up costs	13,270.16	12,831.20	438.96	876.07	1,312.13
Research and development expenses	0.00	0.00	0.00	0.00	5,936,914.32
Concessions and franchises, patents, licences, trademarks, processes, royalties and similar values	25,622,694.71	22,236,865.85	3,385,828.86	3,851,708.10	4,446,159.84
Other intangible assets	272,658.16	205,828.57	66,829.59	8,806.93	17,993.26
Current intangible assets	2,281,860.31	0.00	2,281,860.31	1,982,853.81	1,733,546.12
Advances and down payments on orders of intangible assets	1,672,062.68	0.00	1,672,062.68	1,215,180.43	2,434,520.97
Tangible fixed assets	**487,977,278.38**	**279,147,894.35**	**208,829,384.03**	**217,830,701.69**	**221,757,869.38**
Land, developments and improvements to land	6,805,573.84	711,694.24	6,096,879.60	6,060,330.47	6,039,954.53
Buildings	102,852,092.35	50,266,913.46	52,585,178.89	54,676,816.66	52,973,792.56
Technical facilities, equipment and industrial tools	124,077,728.11	109,205,137.24	14,872,590.87	15,101,830.62	16,720,708.59
Collections	1,067,845.63	0.00	1,067,845.63	1,076,485.40	1,299,274.02
Vessels and underwater vehicles	207,856,512.89	88,425,386.87	119,431,126.02	126,041,117.44	115,906,925.19
Other tangible fixed assets	36,450,061.62	30,538,762.54	5,911,299.08	7,132,988.71	6,062,984.00
Current fixed assets	3,449,688.23	0.00	3,449,688.23	2,519,175.58	7,102,354.86
Advances and down payments on orders of fixed assets	5,417,775.71	0.00	5,417,775.71	5,221,956.81	15,651,875.63
Financial assets	**6,739,026.13**	**345,451.85**	**6,393,574.28**	**6,246,457.45**	**5,980,233.79**
Securities	755,069.93	345,451.85	409,618.08	409,618.08	534,886.48
Other forms of investment (QUAE)	125,000.00	0.00	125,000.00	125,000.00	125,000.00
Other investments	0.00	0.00	0.00	0.00	30.48
Loans	5,503,346.83	0.00	5,503,346.83	5,421,043.27	5,281,870.17
Deposits and guarantees paid	355,609.37	0.00	355,609.37	290,796.10	38,446.66
FIXED ASSETS - TOTAL (I)	**524,578,850.53**	**301,948,871.82**	**222,629,978.71**	**231,136,584.48**	**242,308,549.81**
Stocks and work in progress	**47,444.22**	**0.00**	**47,444.22**	**54,255.66**	**60,713.41**
Raw materials	2,832.56	0.00	2,832.56	2,293.07	3,698.81
Other supplies	44,611.66	0.00	44,611.66	51,962.59	57,014.60
Advances and down payments on orders	**332,930.61**	**0.00**	**332,930.61**	**393,581.31**	**55,569.14**
Accounts receivable	**48,203,715.88**	**246,977.21**	**47,956,738.67**	**40,413,396.76**	**25,071,169.44**
Customer and related accounts receivable	14,519,961.39	246,977.21	14,272,984.18	17,671,195.03	14,865,443.07
Other	33,683,754.49	0.00	33,683,754.49	22,742,201.73	10,205,726.37
Short term investments	**10,502,895.72**	**0.00**	**10,502,895.72**	**24,048,485.05**	**10,630,624.30**
Cash in bank and at hand	13,311,836.07	0.00	13,311,836.07	6,835,480.74	16,232,786.01
CURRENT ASSETS - TOTAL (II)	**72,398,822.50**	**246,977.21**	**72,151,845.29**	**71,745,199.52**	**52,050,862.30**
Prepayments	**132,925.96**	**0.00**	**132,925.96**	**182,317.05**	**112,194.80**
Deferred charges over several financial years	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Unrealised exchanged losses	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
ACCRUALS - TOTAL (III)	**132,925.96**	**0.00**	**132,925.96**	**182,317.05**	**112,194.80**
GRAND TOTAL (I + II + III)	**597,110,598.99**	**302,195,849.03**	**294,914,749.96**	**303,064,101.05**	**294,471,606.91**

LIABILITIES

	2010	2009	2008
Endowment contributions	**1,371,488.39**	**7,697,197.06**	**7,697,197.06**
Contribution	291,138.30	4,111,016.74	4,111,016.74
Additional contribution (State)	543,382.59	2,538,749.66	2,538,749.66
Additional contribution (organisations other than the State)	536,967.50	1,047,430.66	1,047,430.66
Capital donations and legacies	**148,857.58**	**430,125.86**	**430,125.86**
Reserves (incl. Revaluation reserves)	**24,323,979.85**	**16,643,949.86**	**16,257,996.30**
Revaluation surplus	22,046,464.37	24,445,527.00	24,445,527.00
Optional reserves	389,281.80	- 9,689,810.82	- 10,057,538.65
Other reserves	1,888,233.68	1,888,233.68	1,870,007.95
Retained earnings	**0.00**	**0.00**	**0.00**
Financial year performance (profit or loss)	**937,800.11**	**6,646,241.99**	**367,727.83**
Capital grants	**192,317,928.77**	**195,161,242.16**	**207,607,825.70**
EQUITY CAPITAL - TOTAL (I)	**219,100,054.70**	**226,578,756.93**	**232,360,872.75**
Provisions for liabilities	**150,000.00**	**0.00**	**775,774.00**
Provisions for charges	**12,078,980.25**	**11,177,053.67**	**11,190,720.46**
PROVISIONS FOR LIABILITIES AND CHARGES - TOTAL (II)	**12,228,980.25**	**11,177,053.67**	**11,966,494.46**
Financial debts	**3,448.41**	**3,448.41**	**21,674.14**
Holding-related liabilities	3,448.41	3,448.41	21,674.14
Payments on account	**2,264,434.74**	**2,890,559.00**	**0.00**
Operating liabiliites	**55,424,377.53**	**52,239,321.65**	**47,541,071.32**
Trade accounts payable and related accounts	13,538,063.48	13,922,241.19	15,584,868.24
Tax and social security payable	38,971,750.41	34,424,858.20	29,052,395.99
Other	2,914,563.64	3,892,222.26	2,903,807.09
Miscellaneous debts	**5,316,608.56**	**7,876,823.66**	**1,674,988.24**
Liabilities on assets and related accounts	5,316,608.56	7,876,823.66	1,674,988.24
LIABILITIES - TOTAL (III)	**63,008,869.24**	**63,010,152.72**	**49,237,733.70**
Deferred income	**576,845.77**	**2,298,137.73**	**906,506.00**
Liabilities translation adjustment	**0.00**	**0.00**	**0.00**
ACCRUALS - TOTAL (IV)	**576,845.77**	**2,298,137.73**	**906,506.00**
GRAND TOTAL (I + II + III + IV)	**294,914,749.96**	**303,064,101.05**	**294,471,606.91**

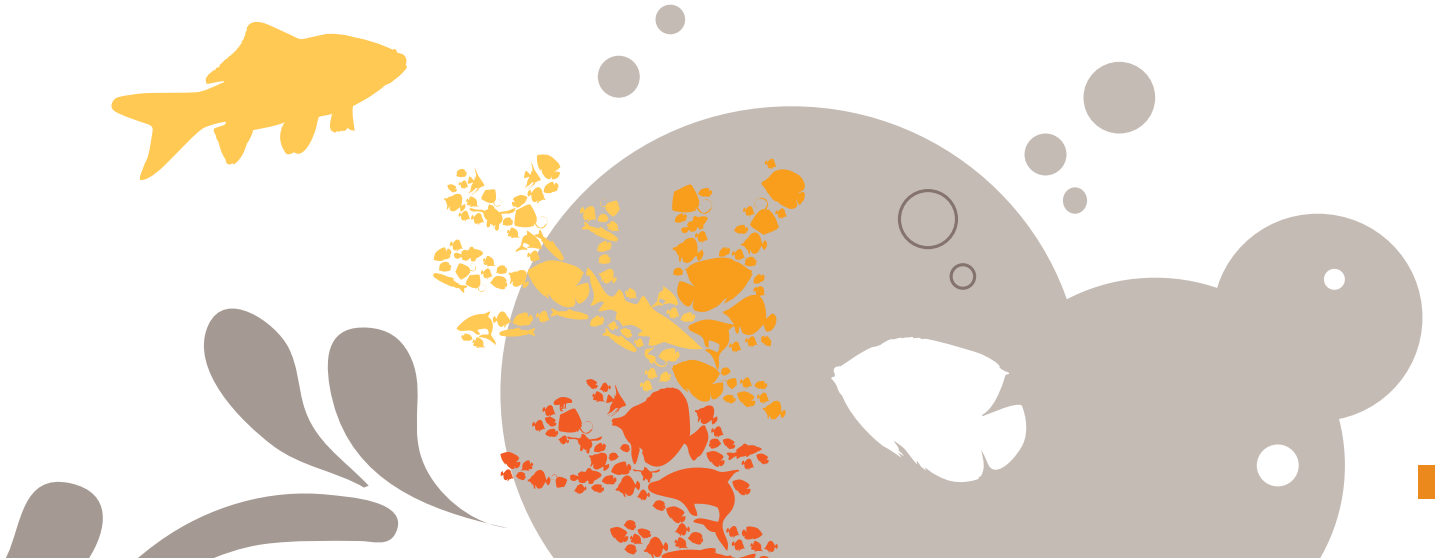
Expenses

	2010	2009	2008
OPERATING COSTS	**220,982,176.60**	**218,190,943.12**	**216,359,483.15**
Purchase price of goods sold during fiscal year	**0.00**	**0.00**	**288,205.97**
Purchase of goods	0.00	0.00	71.23
Inventory changes	0.00	0.00	288,134.74
Consumption from third parties during fiscal year	**79,153,961.72**	**71,383,682.80**	**69,857,570.38**
Purchased supplies in inventory:			
• Raw materials	2,159.19	275.22	2,504.45
• Other supplies	108,817.94	100,014.38	101,634.58
Variation in raw materials and supplies inventory	6,811.44	6,457.75	-8,924.05
Subcontracting purchases	38,060,648.29	31,852,671.95	33,138,880.63
Non-inventory materials and supplies	6,643,874.55	6,682,820.42	6,352,773.95
Outsourcing:			
• outside staff	645,999.16	661,435.29	1,243,380.48
• other outside services	33,685,651.15	32,080,007.79	29,027,320.34
Taxes (other than income taxes)	**9,740,378.72**	**9,686,916.44**	**9,199,741.75**
On compensation	8,459,543.22	8,168,209.53	7,817,913.90
Others	1,280,835.50	1,518,706.91	1,381,827.85
Payroll costs	**98,072,253.85**	**97,478,562.08**	**95,978,840.50**
Salaries and wages	67,640,197.88	66,990,103.24	66,176,285.74
Social contributions	30,432,055.97	30,488,458.84	29,802,554.76
Depreciation and amortisation expenses	**33,175,249.58**	**38,494,046.38**	**40,431,214.75**
On fixed assets : Depreciation allowances	30,471,674.62	36,271,123.38	38,290,251.75
On current assets : Appropriations to the reserve	46,670.00	15,816.00	0.00
For liabilities and charges : Appropriations to the reserve	2,656,904.96	2,207,107.00	2,140,963.00
Other expenses	**840,332.73**	**1,147,735.42**	**603,909.80**
Including special charges	99.00	240.00	4,165.00
FINANCIAL EXPENSES	**15,050.40**	**137,594.74**	**217,594.49**
Realised exchange losses	**9,446.53**	**4,088.70**	**11,594.49**
Other financial expenses	**5,603.87**	**143.64**	**6,000.00**
Amortisation and depreciation expenses	**0.00**	**133,362.40**	**200,000.00**
EXCEPTIONAL	**2,873,832.55**	**3,873,508.65**	**654,950.01**
From operations	**29,399.06**	**138,065.06**	**31,103.82**
From capital transactions (book value of assets sold)	**2,644,067.17**	**516,321.42**	**623,777.66**
Other exceptional expenses	200,366.32	52,303.67	68.53
Amortisation and depreciation expenses	**0.00**	**3,166,818.50**	**0.00**
INCOME TAX	**28,262.00**	**23,012.00**	**53,954.45**
TOTAL	**223,899,321.55**	**222,225,058.51**	**217,285,982.10**
CREDIT BALANCE = PROFIT	937,800.11	6,646,241.99	367,727.83
GRAND TOTAL	**224,837,121.66**	**228,871,300.50**	**217,653,709.93**

Income

	2010	2009	2008
OPERATING	**192,423,731.39**	**189,413,047.67**	**178,343,545.21**
Sales of goods for resale	**52,494.49**	**129,515.28**	**110,648.53**
Sales of finished goods	**23,212,270.58**	**26,407,421.87**	**27,899,396.29**
Revenues from studies and service	21,123,417.43	24,559,424.43	25,980,620.97
Revenues from related activities	2,088,853.15	1,847,997.44	1,918,775.32
Own work capitalised	**2,131,937.93**	**1,219,208.78**	**1,732,518.15**
Operating subsidies	**163,282,212.59**	**157,585,026.44**	**146,421,132.29**
Write back of provisions and transfers of expenses	**1,958,169.59**	**3,071,652.99**	**513,971.29**
Other revenues	**1,786,646.21**	**1,000,222.31**	**1,665,878.66**
FINANCIAL INCOME	**175,049.69**	**221,433.35**	**956,440.73**
From investments	**104,688.00**	**96,780.00**	**67,470.00**
From other investments and loans	**13,055.72**	**13,785.13**	**13,412.00**
Other interest receivable and similar	**2,251.72**	**0.00**	**339.74**
Realised exchange gains	**8,949.41**	**5,015.42**	**9,641.05**
Gains from sales of marketable	**46,104.84**	**97,758.80**	**865,577.94**
Write back of provisions for liabilities	**0.00**	**8,094.00**	**0.00**
EXCEPTIONAL REVENUES	**32,238,340.58**	**39,236,819.48**	**38,353,723.99**
From operations	**17,566.48**	**2,772.21**	**16,875.94**
From capital transactions	**32,220,774.10**	**39,234,047.27**	**38,336,848.05**
Gains from sales of assets	12,434.64	56,658.37	198,883.04
Capital grants transferred to profit or loss for the financial year	32,208,339.46	39,177,388.90	38,137,155.01
Other exceptional revenues	0.00	0.00	810.00
Write back of provisions and transfers of expenses	**0.00**	**0.00**	**0.00**
TOTAL INCOME	**224,837,121.66**	**228,871,300.50**	**217,653,709.93**
DEBIT BALANCE = LOSS	0.00	0.00	0.00
GRAND TOTAL	**224,837,121.66**	**228,871,300.50**	**217,653,709.93**

The net profit for financial year 2010 was 937,800.11 euros compared to 6,646,241.99 euros in 2009.



Ifremer I.D.

Missions

As the French Research Institute for Exploitation of the Sea, Ifremer contributes though its studies and expert assessments to improving knowledge of the oceans and their resources, monitoring the marine and coastal environment and promoting the sustainable development of maritime activities. To this end, we design and deploy observational, experimental and monitoring tools and manage the oceanographic databases. We also operate a great part of the ocean research fleet, including all underwater systems and large-scale mobile facilities and equipment (seismics, penetrometer, etc.). Since March 2011, scheduling and development of the entire French oceanographic fleet are supported by the UMS Fleet joint service unit, whose management has been entrusted to Ifremer for a four-year period

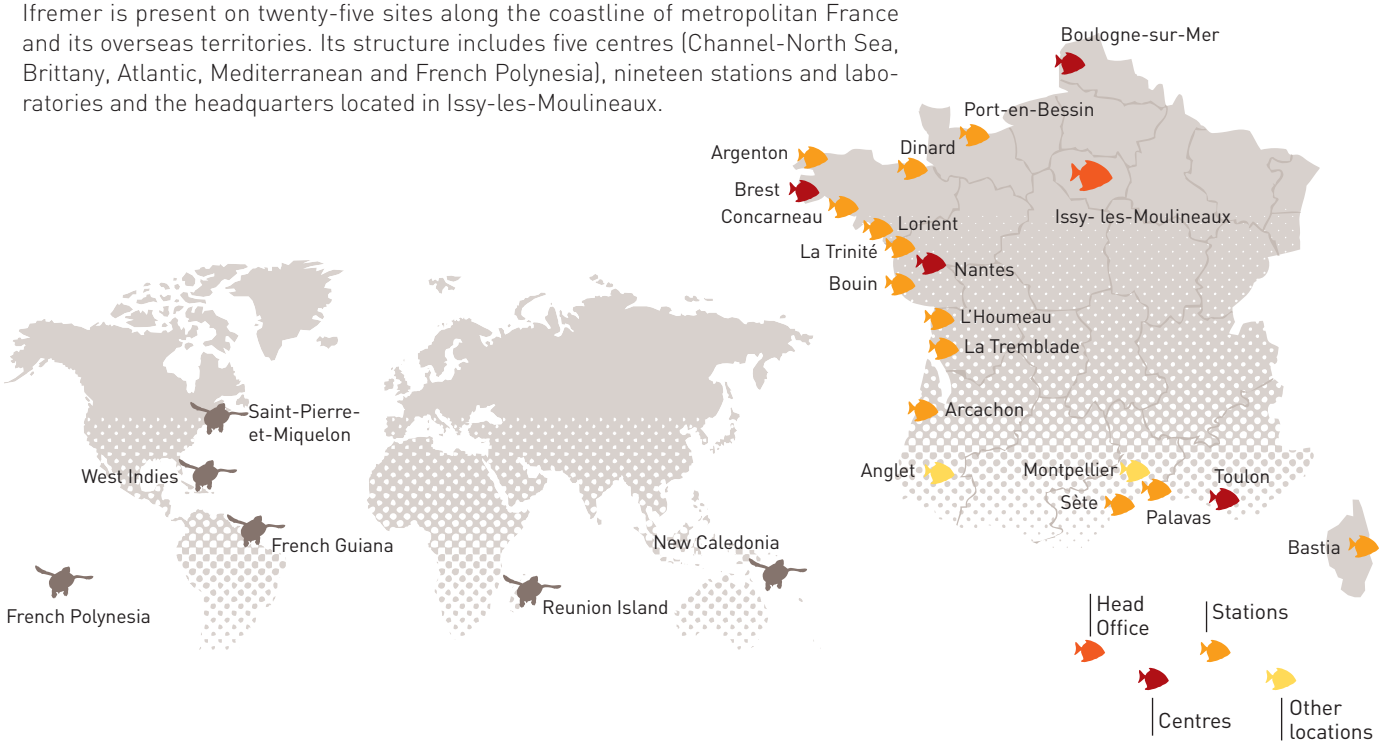
Ifremer is the source of knowledge, innovation, monitoring data and expertise for the marine realm, both in terms of public policy and of socio-economic activity. It is the only organisation of its kind in Europe.

Status and **governance**

Ifremer is a public institute of industrial and commercial nature (EPIC) created in 1984 and placed under the joint supervision of the Ministry of higher education and research, the Ministry of agriculture, food, fisheries, rural affairs and spatial planning and the Ministry of ecology, sustainable development, transport and housing.

Locations

Ifremer is present on twenty-five sites along the coastline of metropolitan France and its overseas territories. Its structure includes five centres (Channel-North Sea, Brittany, Atlantic, Mediterranean and French Polynesia), nineteen stations and laboratories and the headquarters located in Issy-les-Moulineaux.



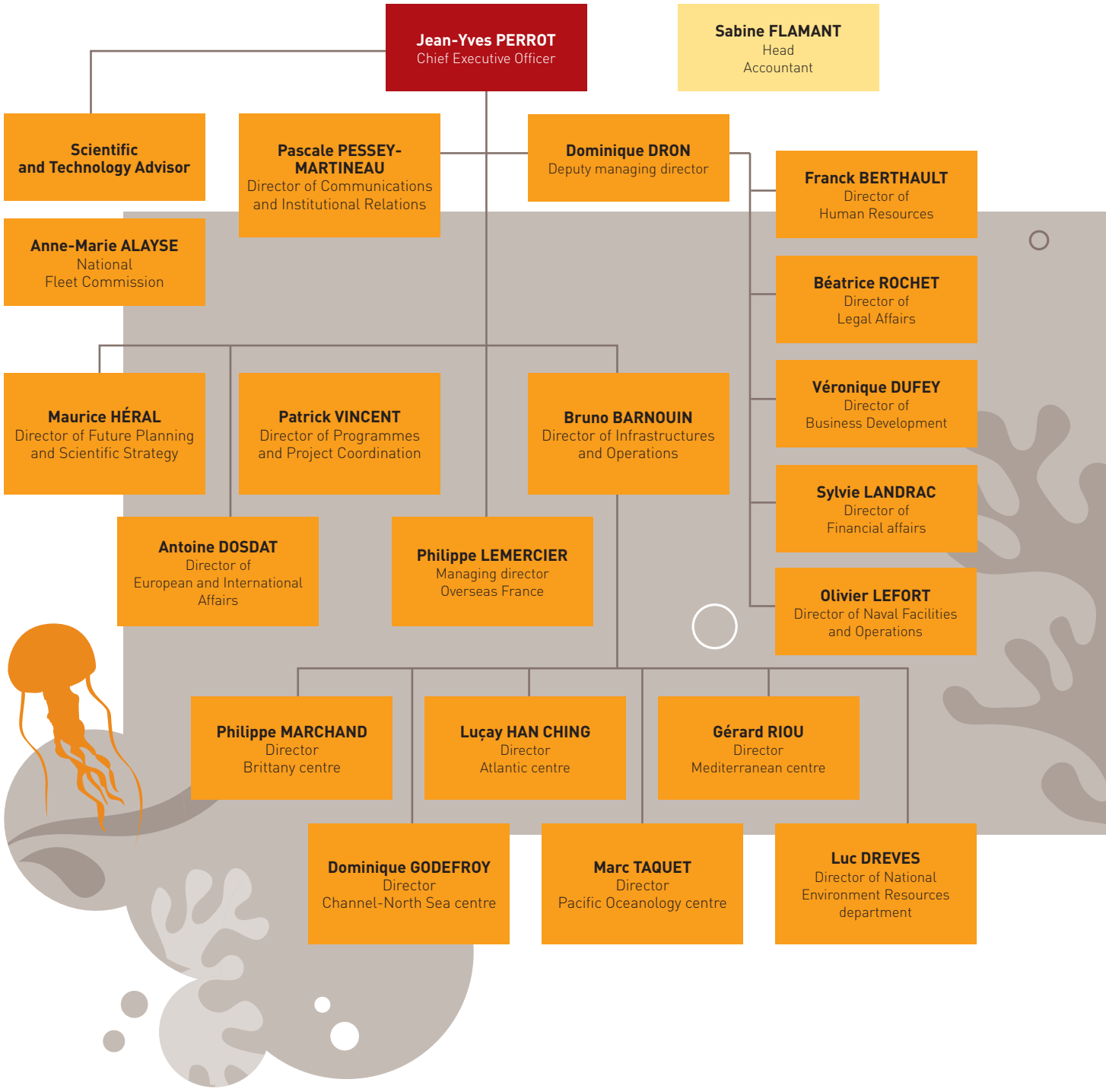
Staff

On 31 December 2010, Ifremer had a staff of 1,503 salaried employees (permanent and fixed-term contracts), 63 PhD students and 27 post-doctoral fellows, in addition to temporary positions and the 372 employees (permanent and fixed-term contracts) at Genavir, shipowners of the ocean research fleet (255 seamen and 117 shore-based personnel).

** natural persons*

Organisation

As of 31 December 2010, the Institute's organisation chart was as follows:



Locations

Headquarters

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Fax 33(0)1 46 48 21 21
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Tel. 33(0)3 21 99 56 00
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http://wwz.ifremer.fr/manchemerdunord

Port-en-Bessin station
Avenue du Général de Gaulle, B.P. 32
14520 Port-en-Bessin
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Brittany

Brittany centre
B.P. 70
29280 Plouzané
Tel. 33(0)2 98 22 40 40
Fax 33(0)2 98 22 45 45
www.Ifremer.fr/brest/index.html

Argenton experimental station
Presqu'île du Vivier
29840 Argenton-en-Landunvez
Tel. 33(0)2 98 89 29 40
Fax 33(0)2 98 89 29 59
www.Ifremer.fr/implant/argenton.htm

Lorient station
8 rue François Toullec
56100 Lorient
Tel. 33(0)2 97 87 38 00
Fax 33(0)2 97 87 38 01

Ifremer Cresco Station
38 rue du Port-Blanc, B.P. 80108
35801 Dinard Cedex
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Fax 33 (0)2 23 18 58 50

Concarneau station
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Le Roudouic
29187 Concarneau Cedex
Tel. 33(0)2 98 97 43 38
Fax 33(0)2 98 50 51 02

Station de La Trinité
12 rue des Résistants, B.P. 86
56470 La Trinité-sur-Mer
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Fax 33(0)2 97 30 19 00

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44311 Nantes Cedex 03
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La Rochelle station
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Fax 33(0)5 46 50 93 79

Arcachon station
Quai du Commandant-Silhouette
33120 Arcachon
Tel. 33(0)5 57 72 29 80
Fax 33(0)5 57 72 29 99

Bouin station
Polder des Champs
85230 Bouin
Tel. 33(0)2 51 68 77 80
Fax 33(0)2 51 49 34 12

La Tremblade station
Avenue de Mus de Loup
B. P. 133
Ronce-les-Bains
17390 La Tremblade
Tel. 33(0)5 46 76 26 10
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Anglet site
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Fax: 33 (0)2 29 00 85 52

Mediterranean

Mediterranean centre
Zone portuaire de Brégaillon, B.P. 330
83507 La Seyne-sur-Mer Cedex
Tel. 33 (0)4 94 30 48 00
Fax 33 (0)4 94 30 44 15
http://wwz.ifremer.fr/mediterranee

Station de Palavas
Chemin de Maguelonne
34250 Palavas-les-Flots
Tel. 33(0)4 67 13 04 00
Fax 33(0)4 67 13 04 58

Station de Sète
Avenue Jean-Monnet, B.P. 171
34203 Sète Cedex
Tel. 33(0)4 99 57 32 00
Fax 33(0)4 99 57 32 94

Corsica station
Immeuble Agostini
SCI Endajola-Pastoreccia
Z.I. de Bastia-Furiani
20600 Bastia
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Fax 33(0)4 95 38 95 14

Overseas

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B.P. 7004
98179 Taravao
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Tel. 00 689 54 60 00
Fax 00 689 54 60 99
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Saint-Pierre-et-Miquelon delegation
Ifremer agency
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97500 Saint-Pierre
Saint-Pierre-et-Miquelon
Tel. 00 508 41 30 83
Fax 00 508 41 49 36

New Caledonia delegation
• Nouméa Office:
101 promenade Roger Laroque
B.P. 2059
98846 Nouméa Cedex

• Saint-Vincent station:
Baie de Saint-Vincent
98812 Boulouparis
New Caledonia
Tel. 00 687 28 51 71
Fax 00 687 28 78 57

French West Indies delegation
Pointe-Fort
97231 Le Robert
Martinique
Tel. 00 596 66 19 40
Fax 00 596 66 19 41

Réunion delegation
Rue Jean-Bertho, B.P. 60
97822 Le Port Cedex
Réunion
Tel. 00 262 42 03 40
Fax 00 262 43 36 84

Boards and committees

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Substitute: Robert DELMAS

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Claire HUBERT
Substitute: Jean-Loup PETIT

Odile GAUTHIER
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Jean-Michel SUCHE
Substitute: Pascal BERGERET

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Fleet Vice-Admiral Xavier MAGNE
Substitute: Captain Laurent LEBRETON

Ministry of the Budget, Public Accounts, Civil Service and State Reform
Aurélien ADAM
Substitute: X

Ministry in charge of Industry
Yves ROBIN
Substitute: Claude MARCHAND

Ministry of Foreign and European affairs
Donatienne HISSARD
Substitute: Éric SANSON

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Goulven BREST
National shellfish-farming committee

Pierre-Georges DACHICOURT
National committee of maritime fisheries and mariculture (CNPMEM)

Charles BRAINE
WWF

Manoëlle LEPOUTRE
Total

Alain RATIER
Météo-France

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Martial CATHERINE, CGT
Raoul GABELLEC, CFDT
Sylvie HUREL, CFDT
Pascal MORICONI, CFDT
Jean TOURNADRE, CFDT
Loïc PETIT DE LA VILLÉON, CFDT

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Ministry in charge of Overseas France

Christine CHOPIN
CCE secretary

Christine COSTE
Government commissioner Ministry of Higher education and research

Pascale DELECLUSE
Chairwoman of Ifremer's scientific committee Météo-France, CNRS

Sabine FLAMANT
Head accountant Ifremer

Brigitte KLEIN
General comptroller for finance and economics «Ecology and Sustainable Development» mission

Contre-Amiral Bruno PAULMIER
Assistant Secretary general for the Sea

Jean-François TALLEC
Secretary general for the Sea


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Scientific committee

The scientific committee reports to the Chief Executive Officer of Ifremer.
It is consulted for advice on research programmes and scientific aspects of technological development programmes carried out by our Institute. It issues recommendations on developing major facilities of general interest which are managed by Ifremer and on proposals for allocating these facilities to the benefit of all users and periodically assesses the outputs and outcomes. The committee meets twice a year.
Its members are very high level scientists holding positions of responsibility in their respective institutions.

Chairperson

Pascale DELECLUSE
Météo-France, CNRS, Paris

Appointed members

Jean-Marie BECKERS
University of Liège, Liège

Gilles BŒUF
National museum of natural history, Paris

Miquel CANALS-ARTIGAS
University of Barcelona, Barcelona

Loïc CHARPY
IRD, Marseille

Françoise GAILL
INEE, Paris

Serge GARCIA
FAO, Rome

Véronique GARÇON
Geophysics and spatial oceanography laboratory, Toulouse

Jacqueline LECOURTIER
ANR, Paris

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Institut Pasteur, Paris

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SHOM, Toulouse

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CNRS, Pessac

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Substitute: Anne-Gaëlle ALLAIS

Karine OLU-LE ROY, CFDT
Substitute: Jean-François PÉPIN

Raymond KAAS, CGT
Substitute: Christelle SIMON-COLIN

Permanent guest members

Bernard DREYFUS
Substitute: Thomas CHANGEUX
IRD, Marseille

Yves FRENOT
IPEV, Plouzané

Pol GUENNOC
BRGM, Orléans

Edwige QUILLET
INRA, Jouy-en-Josas

Jean-François STEPHAN
Substitute: Jean-Marie FLAUD
CNRS/INSU, Paris

Pierre TOULHOAT
Ineris, Verneuil-en-Halatte

Secretary

Nicole DEVAUCHELLE
Ifremer

Living resources committee

The living resources committee is now chaired by a representative from the profession. It ensures the on-going development of relations between the inter-professional entities concerned and Ifremer. To this end, along with plenary meetings where current situations and programme orientations can be discussed, special groups have been created to ensure regular exchanges of information and to build and establish joint operations for research and development.

Chairman

Pierre DACHICOURT
National committee of maritime fisheries and mariculture (CNPMEM)]

Appointed members

Hugues AUTRET
Loire regional fisheries and mariculture committee

Luc BLIN
Federation of small-scale fisheries organizations

Christine BODEAU
Science and the Sea

Goulven BREST
National shellfish-farming committee

Jean-Pierre CARVAL
Local committee for maritime fisheries in North Finistère

Pierre COMMERE
Association of processed food producers

Serge LARZABAL
National committee of maritime fisheries and mariculture (CNPMEM)

Yves LE BORGNE
Satmar

François PATSOURIS
Poitou-Charentes regional shellfish farming section

Philippe RIERA
French union for marine and new aquaculture

Patrick SOISSON
Union of fishery ship-owners of France

Members representing ministries

Bernard COMMERE
Ministry of higher education and research

Jean-Michel SUCHE
Ministry of Agriculture, food, fisheries, rural life and spatial planning

Hélène SYNDIQUE
Ministry of Ecology, sustainable development, transport and housing

Members elected by Ifremer personnel

Fabien MORANDEAU , CGT
Substitute: Gilles SALAÜN

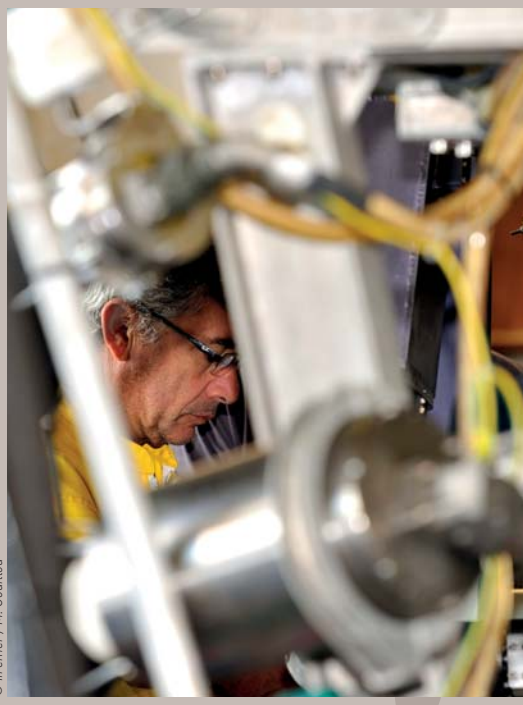
Yves MORIZUR, CFDT
Substitute: Jean-Paul BLANCHETON

René ROBERT, CFDT
Substitute: Claire MARCAILLOU-LE BAUT

Permanent guest members

Pierre CAUMETTE
Laboratory of molecular ecobiology and microbiology, University of Pau and pays de l'Adour

Gérard DEVAUCHELLE
Research station for compared pathology, INRA/CNRS



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Acronyms and abbreviations

AAMP	Agency for marine protected areas
Adecom	Association for community development
Ademe	Agency for the environment and energy management
AERMC	Rhone Mediterranean Corsica water agency
AGU	American Geophysical Union
AMOP	Mediterranean association of producer organisations
ANR	French national research agency
Aquamay	Association for the development of aquaculture in Mayotte
ARDA	Reunion association for the development of aquaculture
ARS	Regional health agency
AUV	Autonomous Underwater Vehicle
BRGM	Geological and mining research bureau
CAMP	Marine protected areas connectivity
CDTI	Centre for the Development of Industrial Technology
Cefas	Centre for Environment Fisheries and Aquaculture Science (UK)
Cemagref	Research centre for environmental science and technologies
CETSM	European centre for underwater technology
CFDT	French democratic labour confederation
CFP	Common Fisheries Policy
CGS	China Geological Survey
CGT	General labour confederation
Cicta	International Commission for the Conservation of Atlantic Tunas
CIESM	International commission on scientific exploration of the Mediterranean Sea
Cites	Convention on International Trade in Endangered Species of wild flora and fauna
Clora	Associated research organisations club
CNAM	National trades and crafts conservatory
CNC	National shellfish-farming committee
CNES	National space research centre
CNPMEM	National committee of maritime fisheries and mariculture
COI	Intergovernmental Oceanographic Commission
COM	Overseas local authority
Comsaumol	Marketing by protection and decontamination of molluscs
Cosri	Research and innovation strategy committee
COST	Scientific and technological committee
CPMR	Conference of Peripheral Maritime Regions
CRCs	Cyclic redundancy check
Creufop	Regional university centre for continuing education
CSTF	Fleet strategic and technical committee
DDPP	County directorate for protection of populations
DDTM	County directorate of territories and the sea
DGAL	General directorate for food
Diren	Regional directorate for the environment
DPMA	Maritime fisheries and aquaculture directorate
Dreal	Regional directorate for the environment, planning and housing
Écoval	Eco-design and value development
EEA	European Environment Agency
ENPI	European neighbourhood and partnership instrument
ERA-NET	European Research Area Network
ESA	European Space Agency
ESF	European Science Foundation
Essec	Business school
FAD	Fish Aggregating Devices
FAO	Food and Agriculture Organization
FIS	Fisheries Information System
FOF	French ocean research fleet
Gerrico	Management of resources and risks in coastal areas
GFA	Aquaculture farms group
GOPS	South Pacific integrated observatory for environment and biodiversity
GPEC	Occupations and skills forecasting for strategic workforce planning
IAC	New Caledonian agronomics institute
ICES	International Council for the Exploration of the Sea
IFM	French marine institute
Ifrecor	French initiative for coral reefs
IGA	Institute of applied geophysics
IGN	National geographic institute
INEE	Ecology and environment institute
Ineris	National institute of industrial environment and hazards
INRA	National agronomic research institute
INRH	National fisheries research institute (Morocco)
INSTM	National institute of marine sciences and techniques (Tunisia)
INSU	National institute for sciences of the universe at CNRS
Intrepid	Integrated and ecological intensification for sustainable finfish farming
IOC	Indian Ocean Commission
IODE	International Oceanographic Data Exchange
IOTC	Indian Ocean Tuna Commission
IPEV	Paul-Émile Victor polar institute
IPGP	Earth physics institute in Paris

IPNC	Institute Pasteur of New Caledonia
IPSL	Institute Pierre-Simon Laplace (environmental sciences)
IRD	Institute of research for development
IRSN	Institute for radioprotection and nuclear safety
IUEM	European institute of marine studies
Jamstec	Japan Agency for Marine-Earth Science and Technology
JPI	Joint Programming Initiative
LEGI	Geophysical and industrial flows laboratory (University of Grenoble)
LER	Environment-Resources laboratory
LESE	Laboratory for environmental studies and monitoring
LPTC	Environmental physico-and toxico-chemistry laboratory (University of Bordeaux)
MEDDTL	Ministry of ecology, sustainable development, transport and housing (ex-MEEDDM)
MEEDDM	Ministry of ecology, environment, sustainable development and sea (now MEDDTL)
Mescal	Extreme environments: colonisation and adaptation strategies in hydrothermal environments
MESR	Ministry of higher education and research
MESRS	Algerian Ministry of higher education and scientific research
MNHN	National museum of natural history
MPA	Marine protected areas
MRI	Major Research Infrastructure
MSFD	Marine Strategy Framework Directive
NAOS	Novel Argo Ocean Observing System
NOAA	National Science and Atmospheric Administration (USA)
NOCS	National Oceanography Centre, Southampton (UK)
NRL	National Reference Laboratory
OBS	Ocean Bottom Seismometer
OFEG	Ocean Facilities Exchange Group
OGC	Open Geospatial Consortium
Onema	National office for water and aquatic environments
PAH	Polycyclic Aromatic Hydrocarbons
PCR	Polymerase Chain Reaction
PNEC	National coastal environment programme
PRES	Research and higher education cluster
Rebent	National monitoring network for benthic biocenoses
REMI	Microbiological inspection network in shellfish-farming areas
Rémora	Network for mollusc aquaculture yields
Repamo	Mollusc pathology network
Réphy	National phytoplankton and phycotoxins network
RMNR	Réunion marine nature reserve
RNA	ribonucleic acid
Rocch	Marine environment chemical contamination monitoring network
ROM	French Overseas region
S3E	Water status assessment system
Satmar	Société atlantique de mariculture
SPC	South Pacific Community
SHOM	Hydrographic and Oceanographic Service of the French Navy
SINP	Nature and landscape information system
SJB	Secondary junction box
SNCM	National Corsica-Mediterranean ferries company
SWIO	South West Indian Ocean
SRC	Regional shellfish farming section
TAAF	French southern and Antarctic lands
TAC	Total Allowable Catches
TIAC	Collective food poisoning
UBO	University of western Brittany
UCLA	University of California, Los Angeles
UMR	Joint research unit
UMS	Joint service unit
Vasque	Autonomous vehicle for water quality monitoring
W3C	World Wide Web Consortium
WFD	Water Framework Directive
Wiomsa	Western Indian Ocean Marine Science Association
WIS	Water Information System
WWF	World Wildlife Fund

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